UNITED STATES ARMY

# AVIATION DIGEST

OCTOBER 1984

## COUNTERING THE THREAT RADAR

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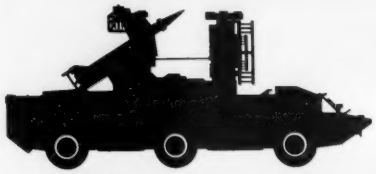

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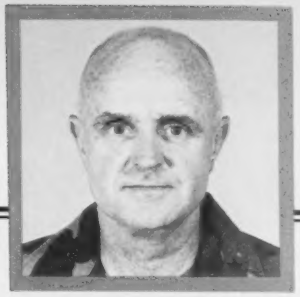
**Major General Bobby J. Maddox**
Chief, Army Aviation Branch



**First ACE Meeting**

NINETY-TWO charter members of Army Aviation's Council Emeritus (ACE) met 13 July at the Home of Army Aviation—Ft. Rucker, for the first time. During their day-long round of briefings and discussions, these retired Army Aviation general officers and colonels took part in a wide-ranging exchange of information and ideas, including implementation of the Aviation Branch. The meeting was more than an update briefing for the retired community, or an effort to prevent us from reinventing the wheel. The attendees gauged the reasonableness and adequacy of branch implementation actions to date.

ACE 84 served as a starting point for a continuing dialogue between active members of the Aviation community and retired soldiers with their wealth of education and experience in training, plans and operations—particularly combat operations.

A key issue facing the Aviation Branch is the need for Aviation unit leaders to be skilled in combined arms tactics—not just in the technical aspects of flight and Aviation unit management.

The challenge of launching and developing the Aviation Branch involves making it an integral part of the combined arms team. We must not be a separate, elite sort of organization that has absolutely nothing to do with what our Army is all about.

To make aviators members of the team we have established the Aviation Officer Basic Course which is designed to develop in new lieutenants who enter flight school the same kinds of field and leadership skills as those gained from the other combat arms basic courses. Also, the Aviation Officer Advanced Course started this summer and is producing captains who can "see the battlefield" and work with their peers as combat leaders.

Our efforts are parallel to similar work of broader scope underway at the Combined Arms Center (CAC), Ft. Leavenworth, KS. LTG Carl E. Vuono, CAC commander, delivering the keynote address to the ACE 84 group, cited the wide range of efforts designed to integrate the work of the Army training centers and units worldwide.

At CAC the integration work is carried on in several dimensions. One refines how battles will be fought at various depths, including how Aviation units participate. This encompasses the "close-in" battle astride the forward line of own troops (FLOT) and also rear area combat operations against enemy guerillas, partisans or elite forces. Consideration is given to the deep battle beyond the FLOT, against follow-on forces, and the vital enemy control and support system.

The ACE group discussed several key considerations that were built into the ACE 84 agenda. Proficiency of aviators in combined arms doctrine and operations was one key point. The role of Army aviators, relating to all other Army branches, was one impetus for the proficiency. Another was the privileged vantage point of Army aviators, less from altitude than from the mobility they provide on the battlefield, using nap-of-the-earth flight techniques.

Another point of concern was the number of flying hours available for training in flight school and in field units. A need exists for mission-oriented tactical training, beyond the technical training required for aircrews.

Helicopter air-to-air tactics and employment, particularly in the process of interservice developments, were also discussed.

ACE members are continuing to contribute even after the meeting. They provide us follow-up input through surveys and comments and will review and comment on drafts of important doctrinal and training literature. I'm looking forward to the contributions that ACE can make to our program.

CPT SCOTT E. PATTON • CW3 CHARLES L. MURPHY • CW3 DAVID P. KLINDT

# COUNTERING THE THREAT RADAR

**Although recent tests proved that threat radar systems can be countered and destroyed, they also revealed that weaknesses exist in countering the threat air defense network. This article will address the active and passive techniques that were used with success and failure within the radar surface-to-air system.**

THE PASSAGE OF lines was conducted as briefed and the zone reconnaissance to establish a screen commenced on schedule. The concept of the operation was to use our mobility as a light team consisting of one AH-1S Cobra and one OH-58A Kiowa to conduct the zone reconnaissance and to establish the screen. As we approached the screen line, we were attacked by the forward reconnaissance element of the aggressor force. Hastily maneuvering for concealment, and despite the use of immediate suppression, the two aircraft were destroyed by radar controlled surface-to-air missiles. The mission was stopped, forces were reconstituted and 10 minutes of station time had elapsed.

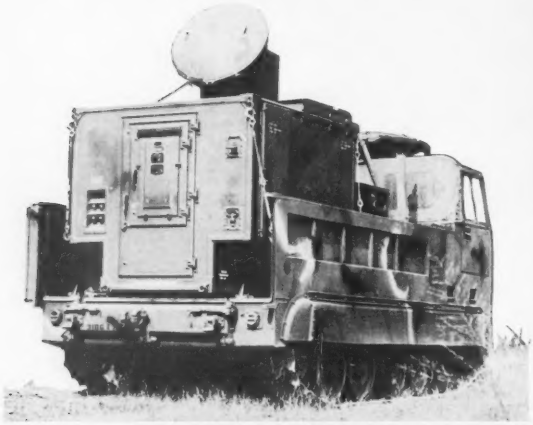
The second attempt was to be accomplished by working semi-independently of each other, with the AH-1S working the western sector (that afforded more cover for the larger airframe) and the OH-58A working the eastern sector (which was relatively flat with little or no suitable terrain for cover and concealment).

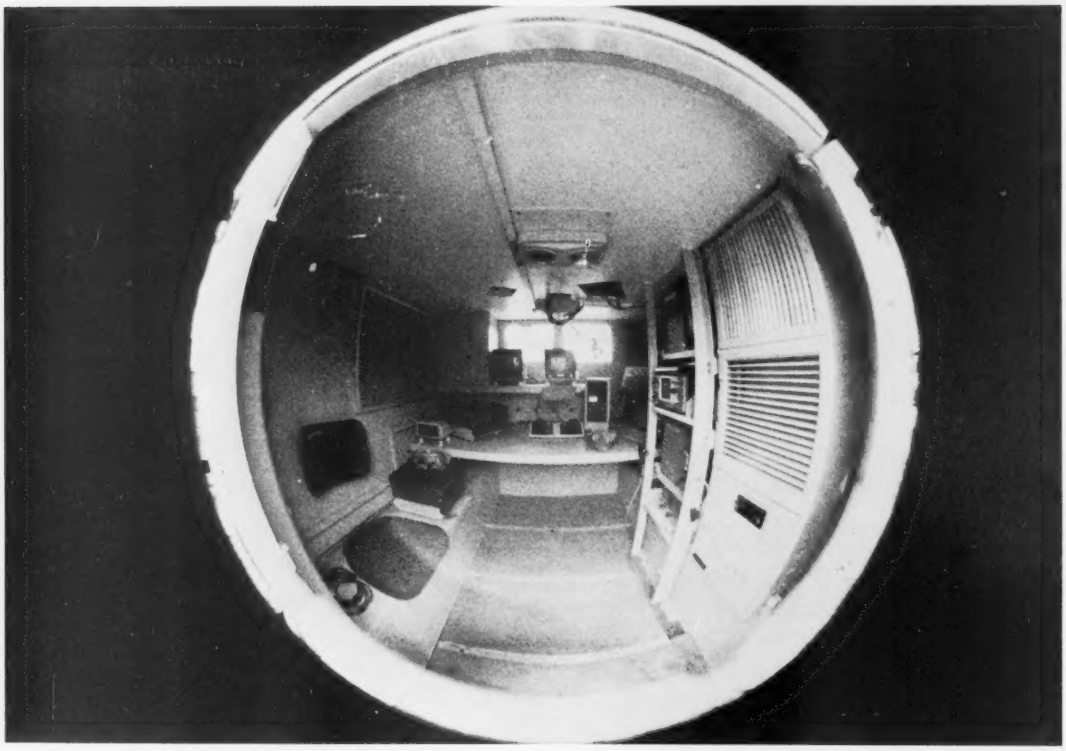
Upon occupation and establishment of the screen, the Kiowa received small arms fire from an advancing tank platoon and its accompanying infantry. The employment of artillery was unsuccessful in delaying or disrupting the advance. Subsequently, the Kiowa was forced from position. Meanwhile the Cobra maneuvered for a flank engagement. After the smoke had cleared we were given credit for one destroyed tank and one tank mobility kill. However both helicopters were again destroyed by a radar controlled surface-to-air system.

The aircraft kills continued through 1 hour and 40 minutes into the mission. A total of four separate team kills were credited to the effectiveness of the opposing force radar and air defense systems. The mission was terminated and the debriefing was soon to reveal common weaknesses among all aircrews in countering the threat air defense network.

The force-on-force phase of the light air cavalry troop test and evaluation conducted at Yakima Firing Center, WA, in May 1983, was the first experience for the majority of the participants in which threat radar systems were integrated into a tactical scenario. Aviators quickly realized that as long as aggressor radar and associated air defense weapon systems influenced the battlefield, distraction from and failure of the primary mission often occurred. The tactical radar threat generator (TRTG) proved to be the primary factor

BELOW LEFT: GRETA being transported on an M114 tracked carrier. AT RIGHT: Interior shows operator station for the tactical radar threat generator. BELOW: Expanded (fish eye) view of GRETA interior.





which influenced the success or failure of the assigned mission.

TRTG or (GRETA) ground radar emitter for training aviators is a mobile J-band radar transported on the M114 tracked carrier. (See "GRETA Has Arrived," July 1980 *Aviation Digest.)*

GRETA was developed and is employed in support of Red Flag operations by the U.S. Air Force at Nellis AFB, NV. It was employed at Yakima Firing Center during the test exercises to simulate threat radar capabilities. The system was predominately employed on high terrain which afforded maximum radar coverage, but which also provided some limited cover and concealment. Standoff ranges from the forward edge of the battle area were used and the system normally operated in a stationary mode.

The opportunity to train with a state-of-the-art system, such as GRETA, was a unique experience through which the participants achieved the maximum training benefit. Techniques to counter the system were developed, experience was gained, eyes were opened and the reality of the situation confirmed previous academic knowledge. Frustration initially summarized the state of the participants' feelings about threat radar systems; however, as the training and the intensity of the exercise continued, frustration slowly transformed into confidence. *Threat radar* and associated air defense weapon systems *can be countered and destroyed.*

Both active and passive countermeasures were employed to counter GRETA and other systems. The techniques employed are not absolute and may not be applicable to other unit missions; however, they proved to have a high success rate in the environment in which the test exercises were conducted.

A detailed analysis of intelligence information coupled with a terrain analysis of probable air defense locations were passive countermeasures that contributed to mission success. The success against aggressor radar was initiated with accurate and timely intelligence relative to threat air defense artillery (ADA). Information received had to be evaluated and incorporated into all mission phases. Detailed planning and the inclusion of all relevant ADA information prepared the aircrews to eliminate surprises and to save precious mission time.

The effective use of the terrain and strict adherence to the proper mode of flight techniques were the keys in avoiding early detection and proved to be the most effective passive countermeasures. However, aircraft were frequently detected ("painted") in the low areas and draws despite being concealed by terrain. Furthermore, on occasion, aircraft were detected when masked. One solution to the problem was to position the aircraft as close as possible to the terrain while masked, or to one side of the draw when moving parallel to the draw or low area. At the onset of the exercise, aircrews reacted to each paint as if an acquisition and track had occurred. As the exercise progressed, however, it was determined that aircraft could still effectively operate for short periods despite being painted. In open or flat areas fast dashes were often the only solution.

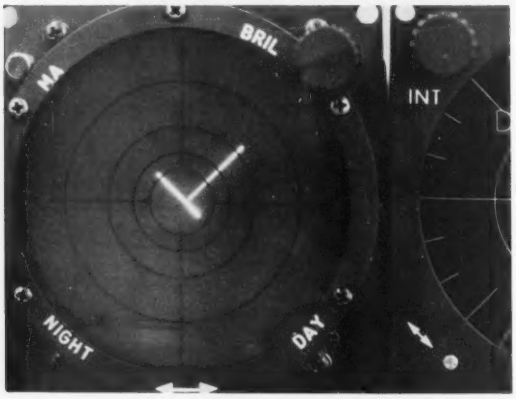
Dismounted observers were employed to the maximum with great success. The frequency with which observers were dismounted was terrain dependent. Compartmented terrain was the most difficult for the conduct of reconnaissance operations; consequently, observers were dismounted from terrain feature to terrain feature. In addition, the use of the direct view optic systems on the JOH-58C aircraft enhanced the overall mission capability of the scout crew. The roof mounted gyro stabilized direct view optics allowed the aircrews to save critical mission time by scanning the area of operation with X10 and X12 power magnification without having to dismount an observer. Nevertheless, deliberate movement to the objective or in the direction of advance was considerably slower because of the incorporation of threat ADA into the scenario.

The effective use of passive countermeasures brought to light several areas of concern that must be addressed. Deliberate movement, use of

the terrain and strict nap-of-the-earth flight techniques enhanced the mission effectiveness of aircrews. In addition, weaknesses in communications and command and control were recognized as a result of the slower movement and loss of visual contact between elements. The use of the high frequency radio was invaluable in alleviating the communication difficulties. Early in the exercise, aircrews placed so much emphasis on avoiding and defeating the radar that the quality of the reconnaissance was degraded. Moreover, attention to other targets in assigned sectors was degraded. The focal point of the operation was often the detection and avoidance of the "invisible target." Passive countermeasures alone did not ensure success but they validated the fact that detection on the battlefield significantly reduces probability of survival and mission accomplishment.

A means to destroy or disable the ADA systems was the ultimate solution in eliminating any influence on the friendly situation. An integral component in the process to neutralize the aggressor radar proved to be the AN/APR-39 radar warning receiver. The AN/APR-39's early cockpit indications of detection coupled with the availability of artillery changed the direction of battle against the invisible target.

**AN/APR-39(V) 1 Radar Warning Receiver**




Upon receipt of the intelligence briefing, a thorough map reconnaissance was conducted to determine the most probable locations of the radar units. Priority of fires was established to neutralize the radars early in the mission. Ground reference points were then determined from which each aircraft would concentrate on fixing the radar sites. Detailed coordination must be accomplished to determine at what phase of the mission the fix(es) will occur. At the ground reference point the aircraft would unmask and using the AN/APR-39 they would determine the azimuth(s) of the radar(s) paintings received as well as the relative intensities and types of radar encountered.

The azimuth indications were then superimposed on the aircraft radio magnetic indicator, which resulted in a magnetic bearing for each radar paint. The boldness of the lines on the AN/APR-39 restricted precise magnetic bearings, yet readings were sufficiently accurate to determine approximate bearings. Nevertheless, the information was plotted on the map and the result was a fan of lines radiating from the ground reference point. The lines were drawn to a distance relative to the radar signal intensities, which again were not precise but accurate enough once a triangulation was completed. The terrain was then analyzed for the most probable threat radar sites.

Each aircrew passed its information to the battle captain or designated aircraft. Since there were a limited number of radar units present during any given profile, this did not present a problem when passing the information by aircraft radio. However, face-to-face coordination may be required where more radar systems are involved. The passed information was then consolidated on a single map in the same manner as the individual aircraft plots. A series of triangulations were then constructed and the most likely locations of the radar systems were noted.

Having realized that to maneuver within the weapon ranges of the AH-1S to destroy the threat air defense system could be a fatal mistake, the call for the adjustment of artillery was employed

for successful target effect. Using the method of triangulation in finding the radar units and suppressing or destroying them with artillery restored the advantage of mobility. The more the system was used and refined the more success was attained. In addition to the use of artillery and the use of the triangulation method, aircrews felt the use of chaff would have been beneficial in countering the radar systems.

The employment of Aviation assets in a high threat environment encompasses a broad spectrum of subjects and areas in which the individual aviator has to be tactically and technically proficient. Knowledge of threat systems, training against those systems and the experience gained are solid foundations in achieving combat readiness. There will be no substitute for training and experience.

The exercises at Yakima Firing Center were a highlight of the training year that proved to be an invaluable training experience against simulated threat radar systems. The success achieved against the systems evolved around the dissemination of timely and accurate intelligence relative to threat ADA, the time afforded the aircrew for extensive mission planning, and command and control of elements during the mission. Most importantly, the Cavalry must have dedicated, indirect fire support when operating well forward or as a covering force and this support must be capable of keeping pace with the mobility of the Air Cavalry.

**Editor's Note:**

**The Army Materiel Command early this month announced that the Army is equipping its AH-1S Cobra and AH-64 Apache helicopters with the new AN/ALQ-136 radar jammer. This survivability equipment will significantly improve the staying power and tank-killing capability of our attack helicopters during the AirLand Battle.**

**Designed to work in conjunction with the AN/APR-39 radar warning receiver, the new automatic radar jammer receives, analyzes and jams incoming radar signals from threat air defense acquisition and tracking units.**

## ABOUT THE AUTHORS

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MONTHLY WRITING AWARD

THREAT BRANCH

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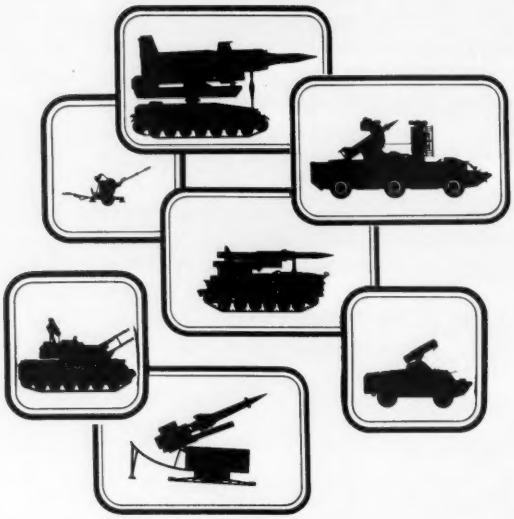


# THREAT AIR DEFENSE

IN THE HIGH threat environment of the modern battlefield, no aviator should leave home without it. No we're not talking about uniforms, flight gear or even that multimillion dollar aircraft. We're speaking more along the lines of knowledge. Knowledge of the enemy, knowledge of his weapons and of their capabilities.

The line pilot has several problems in dealing with the enemy on the modern battlefield, one is his lack of time to study threat subjects. The U.S. Army has published several good field manuals (FMs) and other publications are available from various agencies for our use. These publications usually deal with a somewhat singular subject matter. For example, FM 1-88, "Aviator's Recognition Manual," deals with target identification. No one book consolidates information to show the correlation among various aspects of the air defense threat.

Now we will combine the history, development and deployment of threat air defense weapons into a total and usable picture for the Army aviator. As a finale we will take a look at what to do if we are unlucky enough to encounter threat air defense on the battlefield.

## HISTORY

Using the lessons learned from the Middle Eastern Wars threat forces have developed four basic principles in deploying air defense. Those principles are mass, mix, mobility and integration. The importance of these four keys to air defense is easily seen in the development of modern weapons systems. An understanding of the big four is a must for a further look at their evaluation and importance:

**Mass:** The positioning of as many weapons as possible, so that the combined fire of all can be brought to bear on a single target.

**Mix:** Even with a superficial look at basic types of weapons, it is easy to see that each has its own capabilities and limitations. The principle of mix is to employ gun and missile systems together, which offset

the limitations of gun and missile systems.

**Mobility:** Threat forces have not kept their offensive doctrine a secret. To employ a shock Army in such an offensive role, mobility of that Army is a must. Air defense systems also require mobility to provide their protective umbrella and maneuver with the ground forces. Another key to mobility is in the difficulty of planning a neutralizing attack against a constantly moving objective.

**Integration:** Achievement of this principle requires deployment of air defense systems in depth. An enemy must be faced with more than a single belt of air defense to overcome.

The evaluation and importance of the four principles becomes increasingly clear with an examination of the Six Day War of 1967; the Egyptian and Syrian Armed Forces entered into combat against Israel. The quick Israeli victory was in a large part due to the decisive air superiority of the Israeli Air Force (IAF).

On 5 June 1967, the IAF launched a preemptive strike against their opponents' air bases. The next day the Israeli Air Force Chief of Staff was able to announce that 380 of the Arabs' 500 available combat aircraft had been destroyed. The United Arab Republic's (UAR) humiliating defeat was a direct reflection of their air defense capabilities.

Prior to and during the 1967 war, the UAR's air defense consisted of 150 Russian built SA-2 surface-to-air missiles (SAMs) and these were supplemented by numerous 57 mm antiaircraft artillery (AAA) units. These two systems comprised their entire air defense. The SAM units were located at 25 fixed sites with 6 SA-2 missiles to each site. The majority of the AAA units were deployed into a somewhat stationary defensive belt within Syria. This modest and simple air defense was a minor problem for the attacking Israeli pilots.

With four-fifths of the UAR's Air Force gone and no pure air defense systems moving forward with the attackers, the advancing ground forces sustained almost 60 percent of their losses to Israeli air strikes.

Not one of the four basic principles of air defense deployment was prevalent in the Egyptian or Syrian offensive of 1967. With only two very basic systems available and too few in number to boost the probability of kills, mass was not achieved. Another available factor of mass was not used due to the lack of individual training; soldiers failed to engage air targets with personal and crew served weapons. With only two types of air defense weapons being employed, mix was not sufficiently achieved. To defeat the SA-2s the IAF only had to overcome its radar. With this accomplished the high altitude sector of air defense was clear and the bypass of limited range AAA sites was accomplished. Mobility of air defense was not brought to bear to any degree. The 150 missiles were at fixed sites and had never been moved. With these sites stationary for such long periods of time it was very easy to plan and conduct strikes to destroy them. Integration as an air defense concept was apparently not touched on, either through the lack of available weapons systems or the omission of integration as a doctrine principle.

Following their defeat during the 1967 war, Egypt and Syria began a period of reconstruction which lasted 6 years. A major part of that rebuilding took place in their air defenses. Massive aid was offered by the Soviet Union in the form of training, advice and large numbers of advanced and sophisticated equipment. It was clear in the 1973 war that the four basic principles of air defense had been introduced and were being used.

## DEVELOPMENT AND DEPLOYMENT

With the outbreak of hostilities in 1973 the Israeli Air Force was met with two surprises. The first was the wide variety of new weapons systems. The Soviet Union had introduced new SA-2 systems for high altitude defense; SA-3, SA-4, SA-6 systems for medium and low altitude air defense; SA-7 and ZSU-23-4s for low altitude defense and coverage for the dead zones of the larger SAMs. The second surprise was in their massive numbers and the depth of air defense belts. An important advantage of the new air defense system was mobility. This new-found feature offered greatly improved protection for the advancing ground forces as well as survivability for the weapons systems themselves.

The fruits of the training and rebuilding of the UAR's air defenses came to bear on 6 October 1973 when the IAF lost 30 combat aircraft. This was the first day of the new war, and the greatest challenge ever posed to the Israeli Air Force.

Although the Middle Eastern Wars of 1967 and 1973 were embarrassing defeats for the Soviet satellite nations, valuable information was gained which helped direct the improvement of existing air defense systems, tactics and the development of new systems.

There are many ways to categorize air defense systems. One way is by distinguishing missiles from artillery. However, it might better serve the Army aviator to break these systems down into an order of probability

# THREAT AIR DEFENSE

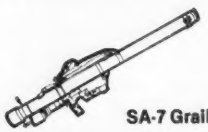
*continued*

of encounter. We'll start with those systems which we would most likely encounter and work our way to those systems which would only endanger Army aircraft in an extreme situation.

7.62 mm rifle

**Small Arms:** These weapons are not usually thought of as an air defense system, but due to the organization and training given combat troops in aerial target engagement, the small arms threat must be considered. It is conceivable, under certain conditions, that a unit as large as a motor rifle company could engage a single target. The major support weapons in such units would consist of about 90 7.62 mm individual rifles and light machineguns, and as many as 3 SA-7 missile launchers. Vehicle weapons systems will vary from unit to unit depending on their missions. A motorized rifle company having BMPs (infantry combat vehicles) would increase their small arms threat by adding 10 7.62 mm vehicle mounted machineguns. The threat of the main gun would be minimal, especially if the unit kept moving. A unit outfitted with BTR-60 P/B personnel carriers would have 10 additional 14.5 mm turret mounted heavy machineguns. All infantry units would, of course, be supported with tanks. All Soviet tanks have 12.7 mm antiaircraft weapons and 7.62 mm coaxial machineguns. The difference between a motorized rifle company and an armor company would be in the proportions of weapons while the types would remain basically the same.

It is important to understand that small arms will always be found most forward on the battlefield and therefore will be the first threat encountered.


SA-7 Grail

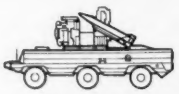
**SA-7 Grail:** The original SA-7s were introduced in 1966 and to date have been improved with only slight modifications. This surface-to-air missile is of particular importance to the Army aviator due to its vast numbers, positioning in every echelon and the ability of the operator to remain under cover, dismounted from easily seen vehicles. The infrared heat seeking missile is about 4 feet long and has a range of 4,800 meters in the modernized version. The SA-7 has a minimum altitude of 45 meters.

ZSU-23-4

**ZSU-23-4:** This mobile antiaircraft artillery weapon system was introduced in 1966. The thin-skinned turret is mounted on a modified PT-76 chassis. It employs four 23 mm liquid cooled antiaircraft cannons each having 4 x 1,000 rounds per minute rate of fire. The radar dish mounted on top provides for a tactical antiaircraft range of 3,000 meters. The ZSU-23-4 will be employed as close as 400 meters behind the forward battalion's leading elements. They will be employed in pairs and will be directly supplemented by SA-7s and the unit's SA-9 Gaskins following with the regiment's main body.

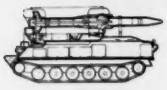
SA-9 Gaskin

**SA-9 Gaskin:** The introduction of the Gaskin in 1974 added an important partner to the short-range low altitude air defense umbrella. It is transported on a BRDM-2A chassis, driven by a 140 horsepower gasoline engine. The chassis mounts four infrared heat seeking missiles that are about 5 feet long and fly at a maximum speed of about mach 2. The solid fuel missiles require optical acquisition of targets and can be fired in a full salvo. The range of the SA-9 missile is 6 kilometers with a minimum altitude of 20 meters. This system will closely follow the ZSU-23-4 and play a complementary role in battlefield air defense, so be sure to plot the forward edge of the battle area correctly.


SA-8 Gecko

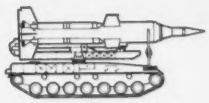
**SA-8 Gecko:** The Gecko was added to the Soviet air defense inventory in 1974. Its 6 x 6 wheel chassis mounts four 10 foot missiles. The vehicle is equipped with its own surveillance, acquisition and dual guidance radars. The range of this command radar guided missile is 12.5 kilometers and its low to medium altitude coverage will be deployed

well forward with the maneuver regiments. The minimum altitude for the SA-8 is estimated at 50 meters.



SA-6 Gainful

**SA-6 Gainful:** The Soviets have benefited from this system since 1966. It provides a highly mobile low to medium altitude air defense. This SAM requires an offset radar for acquisition and fire control. The Gainful will be found forward in combat divisions. The minimum altitude is estimated at 100 meters and maximum range of 30 kilometers.



SA-4 Ganef

**SA-2, SA-3, SA-4:** These systems do not pose a great threat to Army Aviation. Together they are responsible for medium and high altitude air defense. All three of these SAMs are provided with at least some mobility and are assigned to Front and army commands. These weapons are all command radar guided with the lowest effective altitude of 100 meters for the SA-3.

## COUNTERMEASURES

No discussion on any threat subject could be complete without citing how to counter that threat and survive. Countermeasures can be divided into two categories, passive and active.

Passive countermeasures are those preplanned precautions you can take to totally avoid detection. When detection avoidance cannot be guaranteed, or is simply not possible, active countermeasures are used to avoid an accurate engagement by the enemy.

We'll look at both passive and active countermeasures as they apply to the individual systems employed on the battlefield. After an indepth look at countermeasures, we will discuss some basic rules to fall back on in a crunch.

**Small Arms—Passive:** All small arms require a visual acquisition by the gunner. The best possible countermeasure comes with flight planning. The selection of routes and flight modes that would completely avoid visual detection would obviously deny the enemy a target. In some geographic areas, the terrain will not allow for continuous masking. In these cases, employment of the standoff flight technique will afford some protection. The *closest* that one should come to the opponent is just outside the longest range of his organic weapons. Two other possibilities would be to minimize exposure time and aircraft signature. Pilots should attempt to blend the aircraft in with the environment and keep moving while exposed.

**Small Arms—Active:** The time for active countermeasure planning comes with the mission briefing. The best possible and most likely available active countermeasure will be the suppressive fire by friendly artillery units. Another source is engagement of the enemy with available aircraft weapons. Don't forget the possibility of smoke munitions. The idea is to cause the enemy to take cover, deny him visual acquisition, and/or kill him, allowing you to escape.

**ZSU-23-4—Passive:** To avoid detection is to survive. The best possible way to take advantage of this is by good planning and proper terrain flight techniques. Employ the principle of standoff, while minimizing exposure time and aircraft signature. An added possibility (because of the radar used by the ZSU-23-4) is the use of the AN/APR-39 radar warning set. Now would be a good time to become familiar with its operation.

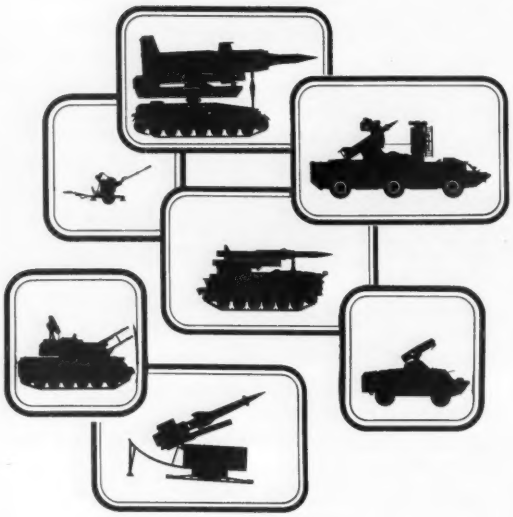
**ZSU-23-4—Active:** As mentioned under the description of the ZSU-23-4, it has liquid cooled barrels, a thin-skinned turret and a very exposed radar dish. The best active countermeasure to exploit these features is the use of suppressive fire. Two other possibilities, if available, are the AN/ALQ-136 radar jammer and M130 chaff dispenser. If these are used, remember, it only takes the operator seconds to switch from the radar to an optical mode, so don't hang around to time him.

**SA-7/SA-9—Passive:** The most effective countermeasure is to use masking and flight over heavily vegetated areas. This will degrade both the SA-7 and SA-9's ability to acquire and lock on its target. Remembering the ranges and battlefield location will help in employing standoff. Be sure to reduce exposure time and aircraft signature. Some additional countermeasures have already been taken for you with exhaust plume suppressors and low reflective infrared paint. If available, the M130 flare dispense system could help in decoying these infrared missiles.

**SA-7/SA-9—Active:** Both of these front line systems require a visual acquisition. Suppressive fire would therefore be the best active countermeasure. Smoke could be used to deny visual acquisition and tracking. The SA-7 will pose a special problem for the use of suppression. Being man-portable, you may never see the gunner as he waits for you to pass before engaging. The best way to counter this problem is a good crew briefing. Ensure all crewmembers are covering every sector of observation and know what to look for. Now would be a better time to train your crewchiefs than when you ex-

# THREAT AIR DEFENSE

*continued*



**Threat Air Defense Countermeasure Rules**

- The best countermeasure for all situations is good flight planning and terrain flight techniques. The goal is to deny the enemy acquisition of a target.
- If the terrain won't provide total cover—employ standoff. To do this you must remember ranges and battlefield placement of different weapons.
- Minimize aircraft signature and keep moving in exposed areas.
- If you have been detected or engaged, shoot back. Don't underestimate the abilities of the 7.62 mm machinegun to make enemy gunners take cover.
- Report any enemy contact as quickly and accurately as possible. This will be helpful in planning of future missions, and you can't use the first rule without good intelligence.

pect them to perform those duties.

**SA-8/SA-6/SA-4/SA-3/SA-2—Passive:** These systems are radar dependent and have a base altitude below which they probably are not going to engage a target or be useful. The best countermeasure would be accurate intelligence briefings and the use of terrain flight techniques, even in the rear areas. The use of the radar warning device will also be very useful.

**SA-8/SA-6/SA-4/SA-3/SA-2—Active:** Though the possibility is slim that an Army aircraft would be in a position to employ suppression on these systems, it is an option, and may under extreme circumstances be needed. All these systems are thinskinned and vulnerable to suppressive fire. Artillery would be the best bet due to the placement of these systems well into enemy territory.

The gist of this indepth look at countermeasures can be reduced into a few simple rules.

Through our look at the 1967 and 1973 Mideast Wars, we have seen the development of basic principles of air defense on a battlefield saturated with highly mobile and lethal weapons. By comparing the two wars, we can see the benefits realized by the threat forces with those developments. Further examination of the Soviet air defense weapons systems reveals that the threat forces haven't stopped with their meager gains of 1973.

Though threat air defense should command our respect, it is hardly unbeatable. By realistic training, a true awareness of the threat and proper use of countermeasures, this giant can be cut to size.

Since the Army at this time does not have a single comprehensive source for threat subjects, it is even more imperative for individual aviators to educate themselves in the overall picture of threat air defense knowledge. So Go For It! Don't get caught without it!

# Update on **UPDATE**

TIRED OF POSTING changes to your operator's manual and checklist every month? Well, we've got the solution; it's called UPDATE. Instead of posting changes, we will issue you a new operator's manual every 4 months and a checklist annually with the changes posted. The manual will be printed on the flimsy paper similar to the Flight Information Publication (FLIP) general planning and approach plates. "Why?," you ask. The reason is simple. It's been more cost effective for many years to reprint the FLIP with all changes than it has been to print just the changes. Two of the major reasons are the paper is cheaper and so is the printing cost. Extra paper is used when you print a change and there is as much "white paper" as there is print. The manual can be reformatted each time a change is printed because it reduces the white paper and it is all done by computer. A new manual can be distributed to the field within 2 weeks from the time it goes to print.

The checklist is another story. These will be printed on plasticized paper stock and distributed annually. The printer will receive these from Aviation Support Command (AVSCOM) and distribute them with the operator's manual. The main reason for that is the new checklist will reflect the procedural changes in the operator's manual and these cannot be used with any previous edition of operator's manuals or checklists. Sure, it's more expensive to reproduce the checklists on plasticized paper, but they are less susceptible to weather, grease, oil and everyday use. That is the major reason to go for a more durable paper and an annual printing cycle.

The first operator's manual and checklist in the test will be for the UH-1 Huey. The other aircraft operator's manuals and checklists are presently being prepared to go into the same format. In the meantime, the work and coordination is continuing with the Adjutant General's office and AVSCOM. To get the UPDATE operator's manuals into the system as rapidly as possible while a contract is being negotiated for printing technical manuals, the UH-1 manual will have a slightly different designation. It will be AR 55-1520-210-10 and no, it will not be an Army regulation. Sometime this fiscal year it will be redesignated as a technical manual, so you cynics will have to live with this situation for a while.

Some of the major significant changes include: no color on the charts and instruments; the text in chapter 7 will be first then the charts will follow; much of the technical data included in chapter 2 and also in the maintenance manuals will be eliminated from the operator's manual; the normal procedures in chapter 8, such as how to pick it up to a hover, will be eliminated. There are many other changes in chapters 8 and 9 that are too numerous to name, and many of them will deal with specific normal and emergency procedures. Some of these emergency procedures will have the wording changed slightly. For example, all of the inflight engine failure emergency procedures will now state "AUTOROTATE" instead of a collective adjustment. Some of the normal procedures will be optional such as the bleed air check. If the mission is terrain flight in the summer, it is highly unlikely bleed air will be needed during the conduct of the mission. Other normal procedures will be moved from runup to shutdown.

There has been a hard look at reducing runup checks that are not mission essential, preflight checks that are normally checked in conjunction with other items, and emergency procedure steps that are obvious or previously stated. This new operator's manual and checklist is a move in the right direction to do things smarter (not because that is the way we have always done them). If we can assist you in the field in any way, don't hesitate to give us a call here at DES.

DES welcomes your inquiries and requests to focus attention on an area of major importance. Write to us at: Commander, U.S. Army Aviation Center, ATTN: ATZQ-ES, Ft. Rucker, AL 36362-5000; or call us at AUTOVON 558-3504, FTS 533-3504 or Commercial 205-255-3504. After duty hours call Ft. Rucker Hotline, AUTOVON 558-6487 or 205-255-6487 and leave a message.

# PEARL'S

*Personal Equipment And Rescue/survival Lowdown*

**Denise Jones** photo by Pat C. Blechle

**ALSE Specialist Course Update**

Two recent graduates of the Aviation Life Support Equipment (ALSE) Specialist Course at Ft. Eustis, VA, received perfect scores throughout the 5-week course. CW4 John Thompson, Hawaii National Guard, Class 18-84, and SGT Richard Harris, A Company, Task Force 160, Ft. Campbell, KY, Class 20-84, were awarded certificates designating them the distinguished graduates of their respective classes. These members of the Aviation community are commended for their outstanding performance and professionalism as displayed throughout the course.

Anyone interested in attending the course should forward their request through their unit training office to CDR, MILPERCEN, 200 Stovall Street, Alexandria, VA 22332-0400. For further information concerning the school, contact CW3 Art Miskimon or SFC (P) Robert Jones at the U.S. Army Aviation Logistics School, Ft. Eustis, VA, AUTOVON 927-2475/4462.

**Optional Conversion of Survival Kit**

The following is a reprint of ALSE message 84-5, 101500Z July 1984.

The purpose of this conversion is to update subject kit at minimum cost and provide more comfort to aircrews by eliminating the hard plastic case.

Survival kit, individual, tropical, tactical aircrew, NSN 6545-00-782-6412, is being replaced by NSN 6545-01-120-2632, under the same name. This item is a component of the SRU-21/P survival vest, small and large.

The updating of this component will require procurement of the following items:

1. NSN 8105-00-837-7754, bag , plastic 6 x 6 inches, unit of issue (UI) is 1,000 (MX).
2. NSN 6505-00-148-7096, povidine-iodine ointment, individually sealed, UI is box of 144.
3. NSN 6510-00-054-7255, skin closure, adhesive, surgical, UI is 500.
4. NSN 8520-00-551-0375, soap toilet, nonfloating, individually wrapped, UI is 1,000 (MX).

After the items above have been received, take the following action:

1. Replace the hard plastic outer case with bag (item number 1 above). This change requires one zip lock bag.
2. Replace the 1-ounce bottle of povidine-iodine with item number 2 above. This change requires 10 packets.
3. Replace the roll of adhesive tape with item number 3 above. This change requires nine skin closures.
4. Add item number 4 above. This requires one soap bar.
5. Remove the 1-ounce tube of insect repellent and the hot weather survival information which are no longer used.
6. Place the remainder of the kit's contents into the plastic (zip lock) bag. Gently remove the air from the plastic bag and seal it.

Place the new survival kit, individual, tropical, tactical aircrew, NSN 6545-01-120-2632 (that you have just completed using the steps outlined above) into the lower right front pocket of the SRU-21/P survival vest.

Pages 2-86 and 2-87, TM 55-1680-317-23&P, "Maintenance Manual for Army Aircraft Survival

Kits," August 1975 and Change 1, August 1981, furnish instructions on procedures to install the PRC-90 radio pocket. This installation should have already been accomplished.

7. Point of contact at this command is Mr. Boone Hopkins, AMCPO-ALSE, AUTOVON 693-1218, Commercial (314) 263-1218 or FTS 273-1218.

**Installation of AN/PRC-90 Radio Pocket**

An article referring to the installation of the new AN/PRC-90 radio pocket, NSN 8415-00-442-3616, on the SRU-21/P survival vest originally appeared in the August 1981 issue of *Aviation Digest;* however, we feel there is a need to reiterate the point as there are units that are not complying with the change. The instructions which follow are also included in Change 1 to TM 55-1680-317-23&P.

**INSTRUCTIONS**

All directions for mounting the pockets will reference the wearer's left or right as if the vest were being worn. All stitching will be U.S. 301 lock stitch, seven to nine stitches per inch, using sage green or olive drab, size "E" nylon thread, FED-V-T-295, back stitch all seams one-half inch.

1. Remove the first aid kit and tourniquet pockets from the left front side of the vest. Remove the vertical seams attaching the inside pocket and fold down. Use care, while removing pockets, not to damage vest body or pockets that will be reinstalled.

2. Remove the antenna cover from the old radio pocket; the contents from the first aid kit and tourniquet pockets may be installed in this pocket.

3. Position the new AN/PRC-90 radio pocket on the left side of the vest, vertically, 1 inch from the zipper closure and 1 inch from the lower edge of the vest; sew in place.

4. Installation of the hunting knife and revolver holster is optional. If the vest is to be equipped with the hunting knife and revolver, position the knife sheath perpendicular and adjacent to the new radio pocket and sew the top half in place. Tack the bottom of the sheath in two places, one turn double using waxed nylon 6 cord, FED-V-T-295. The revolver holster may be positioned at an angle behind the hunting knife sheath and sewed in place.

5. Resew the inside pocket in its original position. Point of contact on this matter is Mr. Hopkins, AMCPO-ALSE, AUTOVON 693-1218 or Commercial (314) 263-1218.

**Water Purification Tablets, Iodine**

The following is a corrected extract from ALSE message 84-4, 171700Z Jul 84. The corrected errors are italicized.

The water purification tablets, NSN 6850-00-985-7166, are components of Army aircraft survival kits, survival vests and individual first aid kits. Recommend that any stock with manufacture date prior to 1972 be disposed of and new stock installed.

Those tablets manufactured by Wisconsin Pharmacal, with dates of manufacture *May 1979* through and including December 1980, were tested and evaluated for serviceability and passed. These stocks should be marked "Retest June 1985," citing Project D830078XX as authority.

All lots manufactured by Van Brode Milling Company during or before December 1971 were tested and evaluated for serviceability and failed. No extensions on these stocks have been approved. The stocks should be surveyed and destroyed citing Project D820251 as authority. Replacement and credit not applicable.

All lots manufactured by Van Brode Milling Company, with dates of March 1973 through and including April 1974, were tested and evaluated for serviceability and passed. These stocks should be marked "Retest December 1984," citing Project D820250SL as authority.

All lots manufactured during 1981 by Wisconsin Pharmacal passed the test and evaluation for serviceability. These should be marked "Retest June 1985," citing Project D830078XX as authority.

All lots that passed testing and evaluation are considered applicable for extension if the bottles have good wax closures and no rusting of metal cans which would indicate poor storage/handling conditions.

ALSE technicians should not remove the wax closure from the bottle when inspecting, just visually inspect the bottle for powdering of the tablets inside. If the wax closure has been removed, the contents are subject to air deterioration making the contents unserviceable.

Point of contact for this article is Mr. James Angelos, AMSAV-MCAPS, HQ AVSCOM, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798; AUTOVON 693-3880 or Commercial (314) 263-3889.

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If you have a question about personal equipment or rescue/survival gear, write PEARL, AMC Project Officer, ATTN: AMCPO-ALSE; 4300 Goodfellow Blvd., St. Louis, MO 63120-1798 or call AUTOVON 693-1218/9 or Commercial 314-263-1218/9.

U.S. ARMY SAFETY CENTER

# Ice... Major Hazard to Winter Flying

ARMY AVIATION units scattered as they are throughout the world must be able to cope with every kind of environment and weather. Cold weather not only makes extra physical demands on ground and aircrews, it poses some special kinds of hazards to safe flying operations.

One of the most hazardous conditions to aviation operations in cold weather is structural icing. While ice may be encountered at any time of the year, it is especially likely to cause problems to low-level flying helicopters in the winter months.

Army aircraft are prohibited from flying into known or forecast severe icing conditions by AR 95-1. If flight is made into known or forecast moderate icing conditions, the aircraft must be equipped with adequate deicing or anti-icing equipment. Weather forecasts are made, however, for all types of aircraft. They do not differentiate between fixed and rotary wing aircraft. Conditions which might result in light icing on one kind of aircraft could cause moderate or heavy icing on another because of the liquid water content and drop size distribution. Nor can a forecast ensure that icing will not be encountered where it isn't expected.

One Army UH-1H crew had received a weather briefing and two PIREPs less than 30 minutes old had indicated there was no ice. Still, the aircraft flying IFR at 10,000 feet encountered icing. Accumulation on the number 2 FM antenna caused it to break off 2 inches above the mount. The leading edge of the tail rotor was dented when it struck the antenna.

**Where ice occurs**

Most icing conditions are found in the vicinity of frontal zones. Icing may occur when warm air is lifted above the frontal surface and cooled to saturation at temperatures below freezing making it contain supercooled water. Icing below the frontal zone outside of clouds occurs most often in freezing rain or drizzle. Precipitation forms above the frontal zone, falls into the subfreezing zone below the front, and freezes on impact with the aircraft.

Icing is rarely experienced where the temperature is -20 °C or lower. It is most common when the temperature is between 32 °F/0 °C and -4 °F/-20 °C and visible moisture such as clouds, drizzle, rain or wet snow is present. Icing may be encountered in some weather conditions at temperatures above freezing. Refer to the appropriate aircraft -10 before conducting cold weather operations.

Aircraft icing usually occurs in cumuliform or stratiform clouds. Such cloud forms are unfortunately found most often in the same airspace where helicopters operate—from sea level to 15,000 feet.

**Cumuliform clouds.** These billowy, heaped-up piles of clouds contain strong updrafts of air capable of supporting large drops of supercooled liquid moisture. When a helicopter flies into this type of moisture, the large drops hit the aircraft, spreading out and forming the most hazardous kind of ice—clear, glazed ice—which adheres firmly to the surfaces.

**Stratiform clouds.** These horizontal layers of clouds normally contain smaller-sized droplets of moisture. When the droplets strike the aircraft they tend to freeze instantly, trapping large amounts of air between the drops, forming rime ice. Rime ice adheres less firmly than clear ice but its rough surface reduces aerodynamic efficiency and it is more likely to shed during flight.

**Mountain flying**

Aviators should be particularly alert for icing conditions when flying in mountainous regions. Upward air currents on the windward side of mountains support large water droplets. These currents, combined with the normal frontal lift as the frontal system crosses a mountain range, create hazardous icing zones, particularly above crests and on the windward side of ridges. This zone may extend to 4,000 feet above peaks, and possibly higher when the air is unstable.

**Types of ice**

**Frost** usually forms on aircraft while they are parked outside in cold temperatures. All frost should be removed before takeoff. This deceptive form of ice affects the lift drag ratio of the aircraft. Frost may also form when a cold soaked aircraft descends from subzero temperatures into warmer, moist air.

**Rime** ice is white, opaque and granular. It is formed by instantaneous freezing of small, supercooled water droplets as they strike the airframe. Rime ice is most frequently encountered in stratiform clouds when the temperature is between 0 °C and -20 °C. Rime is easier to remove than clear ice but its rough surface impedes the smooth flow of air over airfoils. It affects vent scoops as well as leading edges.

**Clear** ice is the most hazardous to aircraft because it is heavy and adheres so firmly. Conditions with high water content, large droplet size and temperatures slightly below freezing are most favorable for clear ice formation. As droplet size increases, there is more latent heat released upon impact. The temperature of the remainder of the droplet is raised for an instant, permitting it to flow back over the surface before eventually freezing as the heat dissipates. Thus, as a large droplet impacts, a small amount will freeze but the greater proportion will run back over the surface to form a smooth, clear coating, with no air trapped within the formation.

**How ice affects aircraft**

Even small amounts of ice on the leading edges of an aircraft's wings can affect lift and thrust and increase weight and drag. Helicopters, whose rotor disc is just another kind of wing that moves through the air at different speeds and varying angles of attack, are even more susceptible to the effects of icing than are fixed wing aircraft. Light helicopters, because of their limited power and faster rotor systems, are the most susceptible of all to effects from icing.

**Rotor blades.** Most helicopters will continue to operate satisfactorily even with quite severe airframe icing (although performance will be degraded). However, ice accumulations on main and tail rotors have an immediate effect on the aircraft's airworthiness. Because the blade is continually moving, there are high random-vibration loads and increased rotor-profile drag. Increased power is required to maintain a given collective-pitch setting. Maneuverability and performance of the aircraft are restricted by accumulations of ice

and the chances of blade stall increase. The negative effects of ice on rotor blades are not normally as severe if the accumulation is uniform.

Arthur J. Negrette, president and chief executive officer of the Flight Safety Institute, and a former Army helicopter pilot, warns "Pilots should not attempt to judge or estimate main rotor blade ice accumulation by observed buildup on the windshield or other parts of the aircraft, since icing occurs at an accelerated rate on the rotor blade as compared to accumulation on the fuselage."

Paragraph 1-3f (5), FM 1-202, *Environmental Flight,* dated 23 February 1983, addresses ice effects on the UH-1 aircraft, "In trying to maintain airspeed and altitude, a 6- to 9-pound psi torque increase was noted after 10 to 15 minutes of flying in programed icing conditions. It is estimated that a buildup of 3/8 to 1/2 inch of ice is sufficient to cause the observed torque pressure increases. With these indicated torque increases, it was not possible to maintain minimum operational rotor speeds during auto-rotations."

**Shedding of ice.** Symmetrical shedding of ice from the blades can reduce weight and restore more efficient configuration, but such shedding must be simultaneous and affect all rotor blades the same way.

If ice is shed from only part of the rotors (asymmetrical shedding) it causes one blade to take up a different rotational plane from the others. The imbalance within the rotor head causes vibration and feedback through the controls. In severe cases, it overstresses components such as pitch change-links and possibly swashplates and scissor links.

Vibration from asymmetrical shedding of ice from a helicopter with two blades is more critical than for aircraft with multiple rotors because the imbalance represents a larger percentage of the total rotor mass.

The effects of vibration can be lessened by reducing forward airspeed to the 60- to 70-knot range. **Shaking the cyclic to induce shedding should not be attempted.** It could place undue stress on the rotor system and make the imbalance worse.

Attempts to induce shedding of ice from rotors not only can result in asymmetrical shedding, ice shed from the blades can cause damage to other parts of the aircraft. Ice shed from the main rotor of a UH-1H struck the tail rotor causing more than $1,500 in damages.

Aircrews and passengers should not exit an aircraft that may have encountered in-flight icing until the rotors have completely stopped turning. Ground crews are also warned to stay away during shut-down. The varied rotor rpm speed is likely to cause shedding of accumulated ice. Large chunks of ice shed from the main rotor have been found at distances up to 300 feet from the aircraft.

**Engine icing.** Ice shed from rotors or other parts of the aircraft may be ingested into engines, causing damage to the compressor's first stage. This hazard is more significant in large, multiengined aircraft.

Except in extremely cold, heavy icing conditions, or when the aircraft is maintaining a high forward airspeed, helicopters with engine anti-icing systems should be able to operate without danger of build-up and ingestion of ice into engines. In extreme conditions, it may be necessary to reduce airspeed to allow the anti-icing systems to recover and cope with ice accretion.

Air starvation may occur when air inlet screens have accumulated ice. FM 1-202 advises that when possible, the air inlet screens should be removed before flight into forecast icing conditions and warns that removal of the screens nullifies the engine air inlet warning light system. Screens on some of the newer aircraft, however, are not to be removed. Consult the operator's manual. If unexpected icing is encountered, aviators should try to exit the area as quickly as possible.

Since helicopters generally fly close to the minimum en route altitude, descending to warmer air levels may not be possible. In that case, finding an altitude between cloud layers or above the clouds may be possible. An alternative is to climb to higher altitudes where moisture in the colder air has been frozen into crystals which do not adhere to the aircraft.

**Effects of ice inside aircraft parts.** A problem that may be overlooked is ice that forms in parts of the aircraft where it isn't easily visible—sometimes while the aircraft is parked and sometimes during flight.

During preflight, the crew of a TH-55A found that the clutch actuator springs and mixture controls were frozen due to ice. Engine start and run-up were normal but when main rotor engagement was attempted there was no result. The IP left the cockpit to troubleshoot the actuator system. While he was outside the aircraft, a quick engagement occured. The result was more than $11,000 in damage to the main rotor blades, dampers and tail boom.

The maintenance manual on the CH-47C warns of the effects of water contamination. If water is left in driveshafts, it will spread due to centrifugal force as the shafts turn during start-up. The spreading creates an imbalance over a much larger area and results in high frequency vibration during flight.

The manual doesn't mention the effects of ice on these same components. A firetruck was used to wash a CH-47C on the afternoon before a scheduled

flight. High pressure caused the water to splash into the synchronizing shafts. During the night the water froze. The sync shaft area was not preflighted and when the engines were started the next morning a condition was set up so that an imbalance was concentrated where the ice was located inside the shaft. This kind of condition results in a severe 1 to 1 low frequency vibration (in relation to the driveshaft rpm). It quickly overcomes the flexion and shock absorbing capabilities of the mounts and couplings and, if allowed to continue even for a short time, will cause damage to the structure of the airframe and possibly even cause separation of one or more driveshafts.

If rags and solvent or a bucket of soap and water had been used to clean this area by hand instead of a high pressure water hose, nearly $3,000 in structural damage would have been averted.

Maintenance safety annexes to unit SOPs should include this point and command and supervisory attention should be directed toward ensuring that maintenance crews and aircrews are aware of the potential problem. It should also be included in safety briefings.

Rain accumulation or condensation of moisture in tail rotor blades can also lead to aircraft damage. Damage amounted to more than $1,000 to a TH-55A when ice formed in the tail rotor. It had rained the night before and then the temperature dropped to + 8 °C. During clutch engagement after the engine was started, the IP felt excessive vibration in the antitorque pedals. Two inches of the aircraft's tail rotor trailing edge had separated.

The old style tail rotor assemblies on the OH-6A are vulnerable to moisture accumulation. Moisture (probably formed by condensation) froze in the tail rotor of one such aircraft and was slung out of the trailing edge near the tail rotor blade tip during flight. High frequency vibration was the likely cause of failure of two of the four tail rotor gearbox retaining bolts, the lower stabilizer fin retaining bolt and the ADF antenna. The crew, who were dressed in heavy winter clothing, noticed nothing abnormal during the flight, the damage was discovered during postflight inspection.

Because of the hazards from icing on helicopter flight operations, the Royal Air Force will spend $12.6 million on a program run jointly by Boeing Vertol and the United Kingdom Ministry of Defence to develop a deicing system which would allow Chinooks to operate continuously in severe icing, down to -20 °C. (U.S. Army Chinooks have been cleared to operate in light icing since the 1960s.) The system trials are providing important information on icing in general; monitoring parameters such as outside air temperature, droplet size, liquid water content and ice accretion thickness will provide valuable information on how and why ice forms on aircraft and the best way of removing it.

In the United States, a program managed by Wichita State University and NASA's Lewis Research Center in Ohio is testing the feasibility of electro-impulse deicing on general aviation aircraft. Professor Glen W. Zumwalt, director of the project, hopes to begin testing a helicopter rotor blade later this year, using the electro-impulse system. The idea for electro-impulse deicing is not new, it was patented by Rudolf Goldschmidt in England in 1939. The Russians have done some testing of the system, but although there was some interest in the U.S. in the 1970s, the program was dropped.

Until more effective anti-icing and deicing equipment is available, crews should take the following actions to minimize the hazard of icing.

- Remove all snow and ice from the aircraft before takeoff.
- Use all necessary anti-ice/deice equipment.
- Avoid flight in clouds when the outside air temperature is between 0 °C and -20 °C.
- If ice is encountered, climb or descend to an altitude where the temperature is colder than -20 °C or warmer than 0 °C.
- If freezing rain is encountered in flight, land as soon as possible. When it is not possible to land, aviators flying instrument flight rules (IFR) should request a higher altitude. If flying visual flight rules (VFR), pilots should initiate a climb and contact the nearest air traffic control for clearance. Freezing rain is usually the result of a warm air mass overriding a cold air mass. If the pilot climbs when he encounters freezing rain, he will normally be entering warmer air.

Aviators should refer to the appropriate -10 for operator and maintenance procedures during cold weather operations. FM 1-230 provides additional clarification of structural icing.

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Sources

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Negrette, Arthur J., "Helicopter Icing Hazards," **U.S. Army Aviation Digest,** January 1981.

Parker, Ian, "Chinook's Trial by Ice," **Flight International,** 28 April 1984.

Warren, David, "A North Sea Offshore Pilot's Perspective on Helicopter Icing," **Rotor and Wing International,** June 5, 1984.

# VIEWS FROM READERS

Editor:

I am interested in acquiring the following articles that were published in your magazine:

- "Aviation Officer Basic Course," April 1984
- "Warrant Officer Candidate Military Development Course," April 1984
- "Officer/Warrant Officer Rotary Wing Aviator Course," May 1984

Thank you very much.

Mark A. Fulco
Randallstown, MD

Editor:

I am writing in regard to a briefing my unit recently received from the Aviation Branch Proponency Team. The briefing was well done, and I am sure I speak for many of the junior aviators that we certainly look forward to the direction that Army Aviation will take in the years to come. It is certainly encouraging to the inexperienced military pilot that emphasis is being placed on the important principles of successful military Aviation operations: combat skills, knowledge of the enemy and leadership.

However, the team also brought to view problems that Army Aviation will certainly have to overcome, to realize its full potential when training and equipping its pilots to be successful combat aviators. During the brief, the team made the audience aware of a program to obtain a new "BDU" Nomex flight suit. Needless to say, the program was less than favorably received by a community of aviators that are constantly subject to tight budgets and a flying hour program that, even under the best management, barely provides for currency, let alone proficiency.

As an attack section leader flying vintage modified AH-1S aircraft, I could hardly help but wonder what the cost of fielding such a unique flight suit would be. Especially, considering the limited financial resources we are all subject to and knowing the Army currently possesses a Nomex flight suit which is effective in its designed purpose—it protects the aviator from fire. The principle of economies-of-scale would argue that the increased marginal benefit (camouflage) derived from such a purchase would not be justified by the cost to produce a product for use by a smaller aviator population when the one currently in use (by the Army, Marines, Navy and Air Force) provides all the utility needed by the aviator when performing his mission and does not degrade his ability to be successful in combat.

The marginal benefit of stealth would not be derived from the BDU flight suit for the aviator performing his mission as it would be by his ground manuever contemporaries in their mission with their BDU uniform. The stealth of an aviator and his weapon system (i.e., attack helicopters) are influenced by the nature of the aircraft and the environments they are employed in. Their stealth is basically derived through realistic training and reliable functional equipment—and maybe some tenacity.

I imagine the increased cost per unit and expense of introducing the BDU flight suit into the supply system would be significant. With so many well deserving and much needed projects being developed, all competing for funds, I find it difficult to understand how this project could receive any immediate attention. However, if the primary concern is to immediately field functional, Aviation wearing apparel, we can make a much more prudent decision on how to spend our limited funds. The "user community," if asked, would most certainly answer that in this category a MOPP suit, compatible with Aviation systems (human and materiel) would certainly be the priority.

If [Aviation] Branch esprit is the concern, we should spend our money wisely in areas that promote a durable esprit in Aviation units. Training, in the form of flight hours, to keep all Army aviators flying would not only maintain morale, but also would provide a considerable return in raising the proficiency of the combat pilot and increase his confidence for battle. It is in the best interests of aviators and ultimately the soldiers they support to be prepared for battle. To accomplish this, pilots have to train; to train they have to fly; to fly units need the funds for costly aircraft flight hours. This could hopefully become the status quo for all Aviation units if we manage our training and money efficiently.

The Aviation Branch is off to a great start. Let's make sure we accomplish the things we must to really be—ABOVE THE BEST.

1LT Matthew J. Mansell
D Company (Atk Hel), 7th CAB
Ft. Ord, CA

**• The *Aviation Digest* has received the following comments from the Aviation Center about 1LT Mansell's letter.**

**1LT Mansell's letter is well written. However, it appears 1LT Mansell does not have access to all information available on the development of the BDU flight suit and, therefore, his letter does not correctly portray the intent of the BDU flight suit program.**

**1LT Mansell makes many laudatory comments about the formation of the Aviation Branch and what impact this will have on improving Aviation in combat skills, leadership, etc. One part of the overall plan to improve Army Aviation is crew survivability. We are continually improving our Aviation life support**

**equipment which includes flight suits as well as such items as helmets and vests. A point 1LT Mansell may not realize is that the recovery of downed aircrews is paramount to continued combat operations and a camouflaged flight uniform has a very tangible benefit to the downed aviator as he awaits recovery in a combat area. While Army Aviation is increasing its capability in combat search and rescue, it must be remembered that a key to its success is the survival, evasion, resistance and escape (SERE) of the downed crewmember. Thus, the development of a more ground compatible flight suit for SERE operations supports the overall plan to make Army Aviation more effective on the integrated battlefield.**

**The estimated cost of the BDU flight suit is $110 as compared to the current CWU-27/P at $83. No special development program is envisioned for the BDU flight suit so the program is low risk and low cost. 1LT Mansell is correct that the CWU-27/P does protect the aviator from fire injury, but that is not all a uniform should be designed to do. Based on the Army Aviation Mission Area Analysis (AAMAA), the CWU-27/P is not fully compatible with *all* Army aircrew duties, especially on the ground. The benefits of camouflage in the cockpit could be debated; however, its value on the ground in a combat zone is a recognized requirement.**

**It must be remembered that the aviator is not in his cockpit 24 hours a day; he spends much time on the ground occupied with other duties, and will not have the time, facilities nor additional clothing to have a separate uniform when he is not flying. Additionally, the BDU flight suit could be of great value if the aviator finds himself in a SERE situation on the battlefield.**

**The cost of introducing the BDU flight suit into the system is being considered. If the benefit the BDU flight suit provides is justified, then a decision to fund this program over others would only be made after careful consideration. In the area of a nuclear, biological, chemical (NBC) uniform, a companion program for an aircrew specific NBC uniform is also in progress, but there are still locations where a non-NBC tactical flight suit is required.**

Editor:

I recently came across a back issue of the *U.S. Army Aviation Digest* (April 1979) and on page 48 found an advertisement for a booklet which interests me very much. The booklet is a reproduction of a three-part article published in the *Digest* beginning in January 1978 concerning the AH-1S Cobra modification program. Realizing that only a limited quantity was available, I would be grateful if you could check for any remaining copies and send one to the above address. Any additional material on the AH-1 Cobra would also be greatly appreciated.

Edwin Tam
Westmount, Quebec
Canada

Editor:

I would like to respond to the article "Aeroscout Observers Need Better Training," by CW3 Wyman *(Aviation Digest,* January 1984), to defend the aerial observer (AO) programs that are active in USAREUR (U.S. Army Europe). While addressing the many problems in training ground scouts to be AOs, the article never presented the current field solution.

Having had the opportunity to train the 19Ds (Cavalry Scouts) as AOs, I agree with CW3 Wyman's position that they were not adequately prepared for AO duties. For example, one of my new 19Ds was afraid to fly! TOE changes within the division transferred the 19Ds from my platoon, leaving me with the need for observers but no trainees. The solution was to train 67V crewchiefs. That solution provided more benefits than expected. Qualification is directed by my unit trainer, CW2 Mack Hall, who established guidelines for AO training in the platoon. Rather than separating the trainees from the unit, they participate *more* by attending selected briefings, reading the reading file and flying on battle drills. Academics is conducted during the time other officers perform their additional duties, and is scheduled around aircraft maintenance. Treating the AOs as crewmembers motivates them to learn their aeroscout missions. Including the AO, from mission planning to debrief, improves understanding and mission performance. Cockpit teamwork develops as it would for two pilots, increasing flight safety. Being crewchiefs adds a maintenance dimension to sustainability otherwise absent.

Perhaps the defense mission in Germany, the constant alerts, and the presence of a hostile border prompt a higher professionalism than CW3 Wyman experienced in his enlisted observers. We now conduct AO border training. DES (Directorate of Evaluation and Standardization) and AORSE (Aviation Operation Readiness and Safety Evaluation) critically evaluate not only the training program but the AOs themselves. Two of my crewmembers have been decorated because of those evaluations. From directing artillery to calling JAAT [joint air attack team], we are providing aircrews who will succeed in the AirLand Battle.

1LT(P) Michael J. Knippel
Platoon Commander
B Co, 3AB(C)
APO New York

Editor:

Please send copies of the following articles that appeared in *Aviation Digest:*

March 1984—"Training the Aviation Warrant and Commissioned Officers"

April 1984—"Aviation Officer Basic Course and the Warrant Officer Candidate Military Development Course"

May 1984—"Officer/Warrant Officer Rotary Wing Aviator Course"

Thank you for your assistance.

ADCM Robert Thurk
USCG Institute
Oklahoma City, OK

Articles from the *Aviation Digest* requested in these letters have been mailed. Readers can obtain copies of material printed in any issue by writing to: Editor, *U.S. Army Aviation digest,* P.O. Drawer P, Ft. Rucker, AL 36362-5000.

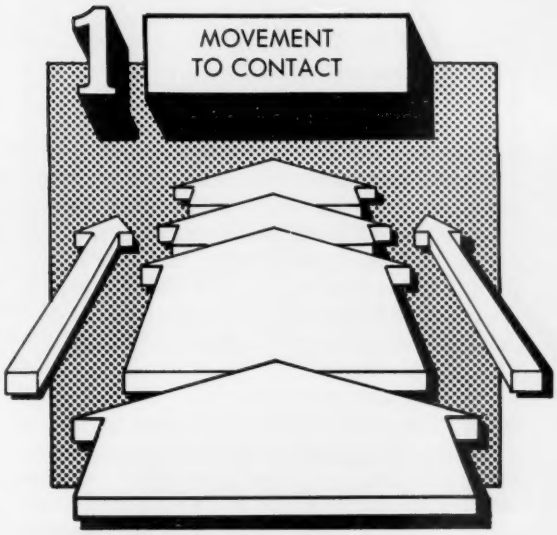
# AVIATION EMPLOYMENT
## in
## Offensive Operations

This is the second in a series of articles about the employment of Army Aviation in conjunction with Armor and Infantry operations. The first, "Aviation Employment In Special Purpose Operations," appeared last month. Copies are available by writing to Editor, *U.S. Army Aviation Digest,* P.O. Drawer P, Ft. Rucker, AL 36362-5000.

**Captain Ron Klein**
Combined Arms Division
Department of Combined Arms Tactics
U.S. Army Aviation Center
Fort Rucker, AL

IN OUR ROLES as commanders, platoon leaders and liaison officers, we will continually be called upon to advise ground commanders on the employment of Aviation assets. The prerequisite for being in a position to give such advice is a comprehensive understanding of the basic operations and, specifically, how ground commanders plan and conduct them. This article covers the five major offensive operations:

- Movement to Contact
- Hasty Attacks
- Deliberate Attacks
- Exploitations
- Pursuits[1]




MOVEMENT TO CONTACT

As the title indicates, a movement to contact is an operation undertaken to gain or reestablish contact with the enemy. Movements to contact may take place after either force has withdrawn, after nuclear or chemical attacks or in the initial hours of movement to a new battlefield. Even when the corps or division is attacking, the leading battalion task forces often will be moving to contact.[2] In fact, most offensive actions will begin with a movement to contact.[3]

1. FM 100-5, page 9-1
2. FM 71-100, page 4-20
3. FM 71-1, page 4-18

As the forces advance, they may encounter an enemy that is either advancing, occupying defensive positions or withdrawing. When an enemy is encountered before your forces are completely deployed for battle, the ensuing action is referred to as a "meeting engagement."[4] (This is a type of movement to contact.) These occur as a result of ineffective reconnaissance. If the force encounters a withdrawing enemy or an enemy in prepared defensive positions, the commander will either transition to a hasty attack, a hasty defense or attempt to bypass the enemy force.

Movements to contact are organized and conducted with two underlying objectives in mind: *security* and *subsequent operations*. An examination of a division in a movement to contact best exemplifies the organizational considerations for any size unit conducting this operation.

All-around security for the main body is provided by the guard forces. They are tasked to protect the main body from enemy direct fires and observation. Depending on the terrain, the guard forces distance themselves from the main body anywhere from a few hundred meters in close terrain, to 3,000 meters in open terrain. Although the guard forces provide a protective shield around the main body, a need still exists for a force to provide early warning, reconnaissance and to run interference. The covering force fills these voids.

The covering force provides early warning, develops the situation and prevents unnecessary delay of the main body. Covering force operations include attacking to destroy enemy resistance, securing or controlling key terrain and containing large enemy units.[5] Consequently, it is a highly mobile, well-balanced combat force operating some distance forward of the main body.

In open terrain where both enemy and friendly forces are employing fast moving combat vehicles, the covering force could be 80 kilometers forward. In close, rugged terrain where forces move at an infantryman's pace, it could be well within the range of the main body's artillery. Normally a division covering force has its own artillery, close air support, electronic warfare, engineer support, air defense artillery and helicopter support.

It is desirable to make initial enemy contact with as small a force as possible. Until you are able to determine the size of the enemy force and its disposition on the battlefield, it is important to conceal your forces.

A negative consequence of the effort to make enemy contact with a minimum number of your forces is that often the moving column may stretch out behind you for an extended distance. Even battalions avoid single column movements to contact, in part, because they "stretch out along a single axis in a 6 kilometer column."[6] Another aspect of movements to contact is that they are conducted with little information about the enemy force.[7]

**Army Aviation in the Movement to Contact**

Air cavalry forces should be deployed with the covering forces as a mobile screen across the entire front. They are ideally suited for this requirement to provide rapid and timely information to the commander.[8] As the covering force encounters forward enemy reconnaissance troops, attack helicopters should be available to destroy them. Attack helicopters also should be invaluable in containing bypassed enemy units until the advance guard can destroy them. Additionally, the mobility and firepower of attack helicopters should often permit the covering force commander to overwhelm the enemy and maintain the initiative rather than pause and marshal the necessary ground combat power to attack.

In order to be responsive to the covering force, attack helicopters must be positioned in successive assembly areas to the rear of the covering force. Assault helicopters obviously can reposition much of the dismounted covering force quickly, without regard to terrain. Since it is generally desirable to cross obstacles in stride, air assault forces can be given the mission to seize bridges, mountain passes or other critical points ahead of leading elements.[9]

Having been tasked with protecting the main body from enemy direct fire, guard force commanders do not want to learn of an enemy flank attack as T-64 tanks crest the nearest hill. They too require advance warning. The air cavalry forces should be given this screen mission. Attack and assault helicopters from the main body should have an on-order mission to reinforce a threatened guard force.

In mountainous terrain, flank guard forces should move along the ridges. Unlike illustrations in field manuals, guard forces in rugged terrain should not be neatly paralleling the main body as they jump from one hill to another. Since guard forces won't be able to keep up with the speed of the main body forces moving along the valley floor, one option is to use assault helicopters to leapfrog flank guard positions along the ridges.

Although the above discussion focuses on a division in a movement to contact, the employment considerations for smaller units conducting this operation are similar. Despite the fact that brigades, battalions and companies will not separate their forces in such a clear manner, their needs will be same and Army Aviation's contribution will be in the same framework. Several different command and support relationships are available. Particular attention must be paid to this issue to ensure that Aviation assets can respond to the crucial battles.

Regardless of the size unit, movement of Aviation units is not continuous. Moves are made to preselected positions frequently enough to ensure that units remain within effective supporting distance of the moving force.[10]

## HASTY ATTACKS

Hasty attacks generally evolve from movements to contact. The objectives are to overwhelm the enemy and to seize the initiative. Speed is paramount; "if momentum is lost, the hasty attack can fail."[11] An attack with speed, audacity and boldness can offset the inherent lack of thorough preparation.[12]

"The hasty attack is characterized by quick reaction."[13] At battalions and below, the execution relies primarily on standing operating procedures and battle drills. Commanders use mission-type orders to maximize their subordinates' freedom of action. Hasty attacks normally begin with a forward passage of lines. If possible, the passage should be through elements not in contact.

Special characteristics for hasty attacks include the need to ascertain the position of enemy defenses quickly. Once initial contact is made, commanders must immediately assess their chances for success.[14] Therefore, it is essential that information about the situation be reported to higher headquarters as soon as possible. Higher level commanders may elect to reinforce the attack, leave the unit in contact to fix the enemy while an envelopment is attempted (aerial or ground), or bypass a strong enemy defensive position. In situations where particularly strong enemy defensive positions are encountered, the

4. FM 101-5-1, page 1-74
5. FM 100-5, page 9-5
6. CPT William D. Hewitt, "Rethinking the Movement to Contact," *Armor*, Jan-Feb, 1984, page 15
7. FM 71-3, page 3-19
8. FM 100-5, page 9-6
9. FM 100-5, page 9-6
10. FM 1-100 (draft), page 8-4
11. FM 71-100, page 4-23
12. FM 100-5, page 9-7
13. FM 71-2 (draft), page 3-38
14. FM 71-101, page 4-10

only feasible course of action may be to establish a hasty defense. The use of reserves or uncommitted forces will be the commanders' principal means of influencing the action decisively once the operation is underway.[15] With strong reserves, commanders have the capability to alter the direction of the main effort and to exploit any unanticipated successes or enemy errors.

One of the major pitfalls in the conduct of hasty attacks is the danger of encountering a numerically inferior force executing a series of delays. Historically, this series of delays has been costly and unproductive for the attacking force. The force ratio advantage that a defender typically enjoys in an initial assault is repeated at each successive delay position. The attackers get bogged down in one killing zone after another as they encounter the coordinated results of obstacles, prepared defensive positions and planned fire support. It is paramount that the attacker either envelop the enemy or mass enough forces at the breakthrough sector to fight through the enemy positions.

**Army Aviation in the Hasty Attack**

The two essential criteria for a successful hasty attack are *speed* and *rapid, accurate information.* Army Aviation can make valuable contributions in both of these areas. Although attack helicopters are least effective against strongly fortified position,[16] they still are very useful in attacks. Attack helicopters can help ground commanders achieve speed by attacking:

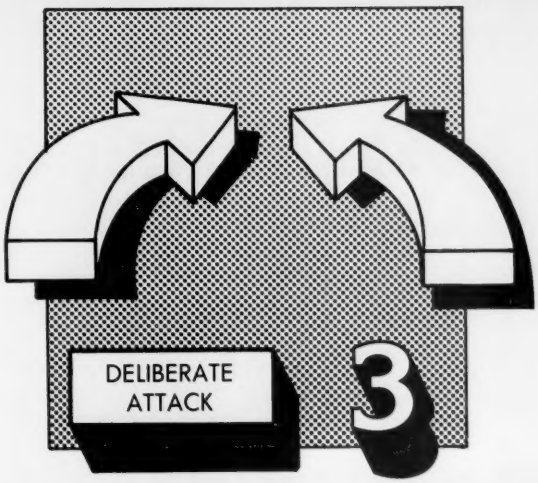
- bypassed enemy units and pockets of resistance,
- withdrawing and moving enemy ground forces,
- enemy rear areas (given vulnerable flanks or penetration),
- enemy counterattacking forces,
- and by providing immediate antiarmor firepower.[17]

Assault helicopters can be committed to reinforce a weakened sector or to exploit a tactical advantage.[18] In the deep battle plan, assault helicopter units can seize key terrain to block reinforcements and to prevent enemy counterattacks. If it appears that the enemy is conducting a delay, assault helicopters can place forces to the rear to disrupt the enemy's delaying tactics and force him to fight in two directions at once.

Air cavalry forces can continue to probe the flanks for information about alternative attacking routes and to locate ground or aerial envelopment routes. The size of the enemy force and the responsiveness of its reinforcements are of critical concern to commanders. In many situations aggressive air cavalry troops can supply this information within the necessary time constraints. Also, air cavalry scouts are often in the best position to adjust suppressive fires from indirect weapons that are so integral to the attack. When the situation is vague and a commander is retaining large reserves, much of the attack and assault assets can also be held in the reserve role. This is particularly true in rugged terrain where helicopters are the only assets with sufficient mobility to reach threatened sectors or reinforce successes in a timely manner.

As indicated in last month's article in this series, helicopters also can be used in supporting attacks and in the deception operations that will take place as part of attacks.

15. FM 100-5, page 9-9
16. FM 17-47, page 4-9
17. FM 17-47, page 4-10
18. FM 90-4, page 5-10
19. FM 1-100 (draft), page 8-4
20. FM 100-5, page 9-7
21. FM-71-2 (draft), page 3-60
22. FM 71-101, page 4-12
23. FM 71-100, page 4-24
24. FM 71-100, page 4-24
25. FM 17-47, page 4-9 goes further to state that, "In a deliberate attack, the ACCB should initially be held in reserve."
26. FM 17-47, page 4-9




## DELIBERATE ATTACKS

Hasty and deliberate attacks differ mainly in degree.[19] Deliberate attacks are usually necessary when the defender is well organized and cannot be turned or bypassed. Thoroughly prepared deliberate attacks are characterized by:

- high volumes of fire
- good intelligence
- extensive preparation of attacking troops
- well developed deception plans
- complete use of electronic warfare
- unconventional warfare
- psychological operations[20]

The objective in deliberate attacks can be either terrain or enemy forces.

The goal of the initial assault is to "bring the maximum combat power of all elements to bear upon the enemy simultaneously, and to destroy him as rapidly as possible, with minimum casualties to friendly forces."[21] Although the overall attack may be a frontal attack, penetration or envelopment, the focus is on penetrations, since that is the most likely mission local ground commanders will receive. Envelopments are preferred, but the enemy seldom leaves his flanks vulnerable to ground envelopments. Aerial envelopments, however, are useful as well as the other offensive operations. After the initial assault, the attack moves into the second phase, the penetration.

Two broad options normally exist when a deliberate attack has successfully breached enemy defenses. The first is to press forward toward the enemy rear area. The second is to turn left or right to roll up enemy positions one after another from the flank.[22] When pursuing this second course of action, commanders must be aware that whenever terrain permits, "the enemy will site his second echelon defenses where they can provide overwatching fires to support the first line defensive belt."[23] As a result of this problem, commanders often prefer a deep drive with the attacking force, seeking to destroy the cohesiveness of an enemy defense. An essential part of this penetration is holding and widening the breach, especially at the shoulders. This mission often is "assigned to follow-on echelons."[24]

**Army Aviation in the Deliberate Attack**

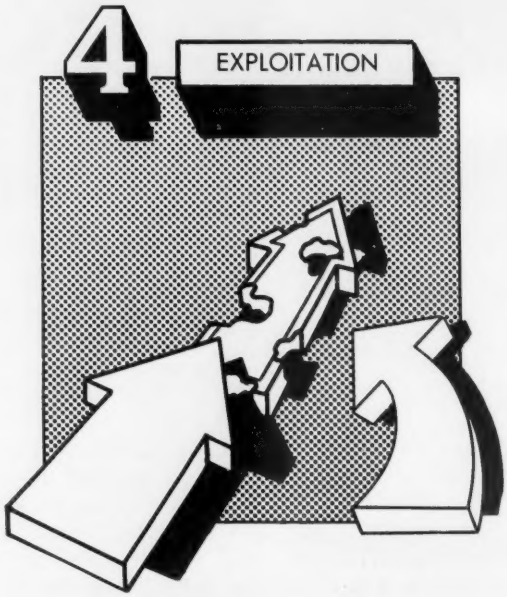
To facilitate discussion of Aviation in the deliberate attack, an arbitrary dissection is made to review the initial assault, actions after the enemy's initial defenses have been breached and supporting operations such as feints, infiltration and aerial envelopments.

In the initial assault against a well prepared enemy force, both sides employ all the artillery, close air support, air defense artillery, small arms, antiarmor weapons, rockets and armor that can fit onto the battlefield. The vulnerability of helicopters to such fires often precludes use of helicopters in the initial assault.[25]

After ground forces have breached the enemy defenses, air cavalry forces can move through the penetration and outward on the flanks where the enemy is fragmented and weak. There, they reconnoiter to locate counterattacking enemy forces and soft critical targets (command posts, artillery batteries, communication centers, resupply vehicles, etc.). Once these targets are located, air cavalry selects routes and attack positions for attack helicopters.[26] Air assault forces also can move through the penetration to seize key terrain or reinforce the shoulders of the breach. Attack helicopters are best suited for attacking enemy armor formations on the move. Having moved through the penetration, this capability makes them particularly useful to destroy or repel an enemy counterattack or moving reserves. They can also contain pockets of resistance bypassed by the main force.

If the plan calls for the ground forces to turn and roll up the enemy flanks, attack helicopters often can be positioned to offer the necessary suppressive fires (rockets; TOW and HELLFIRE missiles; joint air attack team; or artillery) on the enemy second defensive belt to allow ground commanders to proceed with their missions.

The success of a deliberate attack is obviously enhanced by cross-forward line of own troops (FLOT) raids, deep strikes, infiltrations and aerial envelopments. Air assault forces, in particular, can conduct cross-FLOT strikes into the enemy's rear area, attack artillery positions, command posts, logistics, communications facilities and seize key terrain. If the terrain is particularly difficult on either flank, the enemy will have light defensive positions on the flanks, and our attack helicopters and air cavalry forces can conduct the same missions listed above without having to go through the penetration. Even in rugged terrain, however, the success of such aerial envelopments hinges on the effective suppression of enemy air defenses (SEAD). In fact SEAD is critical to the success of all of our operations. In particular, SEAD *must be integral* to the planning process and *not merely on call.*




## EXPLOITATION

The purpose of the exploitation is to prevent orderly withdrawal of the enemy.[27] As a successful attack continues, the enemy force has increasing difficulty in the execution of a cohesive defense through each succeeding defensive belt. Indications of such difficulties on the enemy's part are:

- A general decrease in resistance.
- An increase in the numbers of prisoners being captured.
- Overrunning the enemy's artillery positions, command posts, signal installation, supply dumps and supporting units.[28]

The exploitation is an opportunity to make significant gains well beyond what normal force ratios dictate; in a matter of a few days, more gains can be made than in months of other operations. Exploitation forces should be large and reasonably self-sufficient. Well supported by Air Force close air support, and Army Aviation, they should be able to change direction on short notice. The mission is executed by rapidly advancing toward the enemy rear, bypassing "pockets

27. FM 100-5, page 9-2
28. FM 71-100, page 4-25
29. FM 17-95, page 6-38
30. FM 100-5, page 9-16
31. FM 71-100, page 4-25
32. FM 100-5, page 9-17
33. FM 100-5, page 9-17
34. FM 17-50, page 5-7
35. FM 1-100 (draft), page 8-9

of resistance, and destroying lightly defended and undefended installations and activities."[29]

Overall planning for the exploitation begins with plans for the movement to contact or the deliberate attack. "As the battle progresses, commanders will normally designate exploiting forces by issuing fragmentary orders during the course of an attack."[30] A terrain objective, often some distance away, is assigned to the exploiting force. It may be a critical communications center, a mountain pass, crossroads or other area that if captured significantly contributes to destruction of organized enemy resistance. Also the objective may be a force-oriented one or, it "may simply be a point of orientation and serve no other purpose."[31]

The advancing ground maneuver force normally exploits on a broad front with task forces moving abreast against the enemy. The force must be speedy, bold and aggressive in reconnaissance, prompt to use firepower and quick to employ uncommitted units. Most exploitations will be initiated from the front rather than directed from the rear and control should be as decentralized as the situation permits. "The commander must be careful not to dissipate combat power in achieving minor tactical successes. His aim is to reach the objective with the maximum strength as rapidly as possible."[32] Exploitations continue day and night and historically they have been halted by an inability to maintain their logistics rather than action by the enemy force.

The unique aspects of exploitations are, *first:* unusually small reserves are held. Due to the aggressive nature of exploitations, leading elements "maintain only those reserves necessary to ensure flexibility, continued momentum and essential security."[33]

A *second* consideration is, if strong enemy defenses at selected positions are encountered, and if the exploiting force cannot overwhelm these strong points rapidly or identify them and bypass them, the entire exploitation ends.

A *third* important factor in exploitations is the continuing demand on troops and equipment as the all-out effort continues nonstop. Fatigue and stress on personnel, due to the pace and lack of equipment maintenance, become increasingly critical and cannot be disregarded.

A *fourth* critical aspect is maintaining momentum. Any lull in the push forward creates opportunities for the enemy to begin construction of a defense line.

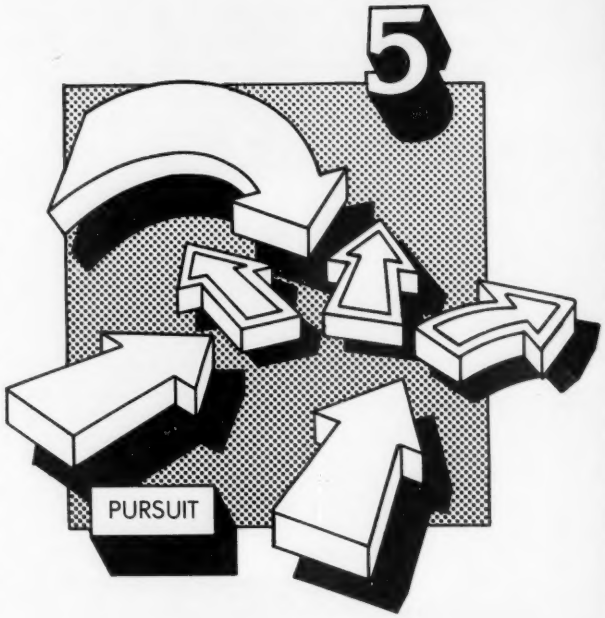
A *fifth* consideration that can be extremely dangerous occurs when facing a well-equipped, large enemy force. Following Hannibal's example at Cannae, the enemy may feign a weakness and allow the attacking force to gain some success. Then, after creating a salient and transitioning into an exploitation with a commitment of all your forces, the enemy has major reserves which attack at your flanks and rear to encircle you. As the Romans who opposed Hannibal discovered, this is a deadly turn of events. Commanders will rely on an array of long-range information sources to avoid this trap, but threat forces are skilled in deception *and* in large scale operations. Commanders must be wary of this possiblity!

**Army Aviation in the Exploitation**

Many consider the exploitation to be the single operation where Army Aviation can contribute the most. Aviation employed with ground forces operates very much as in a movement to contact,[34] attacking successive positions to enhance momentum. Concurrently, the speed of the exploitation stretches the ground forces to their limits. This results in an increase in demands for Aviation reinforcements: to move command and control elements, to provide fire support, to transport supplies and to provide aerial communication relays. However, at this point, particularly, Army Aviation combat missions should take priority over a support role.

Because of its "inherent speed, mobility and firepower, the combat Aviation brigade (CAB) is ideally suited to the fast tempo of exploitations."[35] When the terrain and enemy defenses on the flanks are similar to the breakthrough sector, it is advisable to send the CAB force through the penetration (avoiding the shoulders) to attack deep targets and to seize key terrain such as important river crossing sites or vital enemy communications facilities. Attack helicopters can interdict enemy armor retreating forces or reinforcements.

Assault helicopters seize obstacles to block the retreating enemy. If the adjacent terrain offers less in the way of enemy air defense artillery defenses and small arms, it may be more advantageous to conduct an envelopment to cut off the enemy withdrawal. The CAB's inherent mobility




also can compensate, in large part, for the minimal ground force reserves in the exploitation, if careful attention is paid to the control measures specified in the operations order.

Air Cavalry forces can identify enemy escape routes, enemy reinforcements, lightly defended assets, strong enemy positions and perhaps most importantly, determine any geographical limits of the enemy weakness. As opposed to other information sources (side looking airborne radar, RF-4s, satellite photographs) the cavalry does this within the commander's immediate time constraints. Screening cavalry forces also can identify locations where the enemy is attempting to establish a defense. Then, they can coordinate suppression until air assault forces can arrive to rout the enemy and even occupy the same blocking positions established by the enemy forces to trap the withdrawing enemy.

Ground assets should be the direct pressure force. Aviation forces should not get involved in battles of attrition with bypassed enemy forces.[36] Consider the following scenerio as an example of an exploitation: Advancing ground forces, driving deep to destroy the enemy's support system....As the exploiting force continues, it encounters friendly air assault forces holding key terrain and crucial road intersections. Also, they continue to receive reports from air cavalry forces that enemy forces to their flanks are weak. The advancing ground force commander is informed of moving enemy reserves. Simultaneously, he has been informed that the attack helicopters are engaging and destroying those reinforcements. It should be apparent that the ground commander's gains in this exploitation have been a direct result of Army Aviation's contributions.

36. FM 17-47, page 4-14
37. FM 71-3, page 3-22
38. FM 100-5, page 9-19
39. FM 100-5, page 9-19, 9-20
40. When available, Air Force assets should be considered as the delivery means for many of these area denial weapons.

**PURSUIT**

Pursuit operations complete the destruction of an enemy force that has lost the ability to delay in an organized fashion and is attempting to disengage and withdraw. The pursuit is a logical extension of exploitation. After the exploiting force has succeeded in preventing a reconstruction of an orderly withdrawal and the enemy begins to flee in a disorganized run, a transition is made to the pursuit.

The pursuit differs from the exploitation in the sequence of operations. Another important difference is that, "Unlike exploitation, in which the attacking forces avoid enemy units in order to destroy their support system, in pursuit, the attacker focuses on the major enemy force."[37] A deep terrain objective may be designated, but the enemy force is the primary objective. Because of the enemy's disorganization, pursuit "allows greater risks than other types of offensive operations."[38]

In the conduct of a pursuit, two separate forces are designated. The first is a direct-pressure force that conducts a series of hasty attacks to maintain forward momentum and to inflict maximum casualties. Preferably, armor-heavy forces would continue day and night with unrelenting violence. The second force is an encircling force that moves as swiftly as possible to cut off the enemy retreat. Obviously, the encircling force must be at least as mobile as the enemy. The enveloping force advances along routes parallel to the enemy's line of retreat to reach key road intersections, bridges and mountain passes before the enemy, then establishes strong blocking positions to "cut the enemy's escape routes."[39]

Despite the lack of time available for planning and coordination between units, the transition to the pursuit must be rapid. Commanders of all units in exploitation must anticipate the transition to pursuit and consider new courses of action on a continuing basis.

Many of the characteristics of pursuits and exploitations are identical. Traditionally, both operations have been stopped by fatigue and resupply limitations. There are also some additional aspects unique to pursuits. *First,* the direction of movement is determined, in large part, by the direction of the enemy movement and terrain. In some terrain, it is difficult or impossible to predict the course of enemy withdrawal. This increases the difficulty of blocking the withdrawal, and places a greater demand on the attacking force's mobility and communications capability.

A *second* aspect of pursuit operations is the large requirement for engineer support. Minefields, log and wire obstacles, tank ditches and craters, rubble and blown bridges go a long way in facilitating the destruction of the enemy force by channeling the enemy into preselected routes, cutting escape routes and blocking his withdrawal. Fires, chemical contamination, scatterable mines and tactical nuclear weapons[40] (contamination, fires or trees blown down) also can be used to compensate for insufficient combat troops and accelerate the destruction of the enemy force considerably.

A *third* aspect to be aware of is that success may be limited, due to enemy exfiltration. Depending on the terrain and leadership in the enemy force, a great deal of exfiltration may be expected. Although a large effort should not be diverted to prevent the escape of small patrols, it is important to seal off all possible escape routes. At this stage, they're on the run, they're disorganized, and quite possibly short of ammunition. Anyone who escapes will have to be faced next week or next month, rearmed on another battlefield.

A *fourth* concern in pursuits is encountering an enemy force establishing a strong defense of encircled forces. When faced with a rapidly decaying situation and having been informed of friendly forces in blocking positions to his rear, the enemy very likely will attempt to stop at a defensible piece of terrain and dig in. Cities and mountain passes are prime locations for such an attempt. As more enemy forces fall back, they can be incor-

porated into the defensive perimeter to strengthen it. Pursuit forces must always be aware of this possible development and subvert such an effort as soon as it is discovered. Every minute counts as the enemy attempts to reorganize for an all-around defense.

**Army Aviation in the Pursuit**

Obviously, the encircling force should make maximum use of Army Aviation resources. Attack helicopters can attack the enemy's flanks to expedite the disintegration of his delay during movement. They also can reinforce blocking positions to the rear. Assault helicopters can assist the ground forces by the delivery of critical supplies and aerial delivery of mines. As part of the CAB assigned the encircling force mission, air assault forces can easily outdistance the enemy to establish blocking positions.

Although enemy defenses are relatively light and disorganized, they do exist and the task organization of the air assault task force must include attack helicopters. The blocking positions must be strong. The enemy probably will conclude that the attacking force to its rear must be airborne or air assault forces and consequently they lack full support of artillery and armor. In his desperation to escape from an ever-closing trap, the enemy will muster all the resources possible and launch a breakout attack.

Attack helicopters must be available to assist, and air cavalry forces should provide valuable information about the size, rate of advance and composition of a break-out effort. Air cavalry forces also can assist greatly by reconnoitering the withdrawing enemy to determine routes of retreat, exfiltration routes and where the enemy is located.

The cavalry forces should also screen to warn of any enemy reinforcements or flanking actions. For continuous operations, air delivered forward arming and refueling points will have to be established and the cavalry can be expected to locate potential locations and routes for the UH-60s, CH-47s or C-130s delivering fuel.

The five offensive operations discussed above generally will be sequential. Ideally, the movement to contact will develop into a hasty attack; enough resources can be marshaled quickly to be successful in the hasty attack, transition into the exploitation and eventually into pursuit operations. In actual operations, the battle will progress from the initial movement to the final termination as one continuous operation. The separation into stages (types of operations) is somewhat arbitrary and is done to facilitate planning as well as to provide an understanding of the varying considerations at each stage. However, in the analysis of a battle it will be difficult to establish when the exploitation ended and the pursuit began.

The underlying prerequisite to all the offensive operations is speed. "Move fast, strike hard and finish rapidly,"[41] is one of the combat imperatives; and meeting that requirement with scarce Aviation resources is the reason that intelligent employment of Army Aviation is crucial. Army helicopters certainly have the mobility to meet the varying demands of these offensive operations. Our education and mental flexibility must be commensurate.

This coverage of the five major offensive operations is not intended to be limiting in any sense. Ideally, this series will serve as a starting point for a discussion of the employment options of Army Aviation assets. Comments from readers are solicited, and should be sent either to Editor, *Aviation Digest,* P.O. Drawer P, Ft. Rucker, AL 36362-5000, or to Commander, USAAVNC, ATTN: ATZQ-CAT-CA-C (CPT Ron Klein), Ft. Rucker, AL 36362-5000.

41. FM 100-5, page 2-6

# HOW TO GET THE

UNITED STATES ARMY
AVIATION DIGEST
The *U.S. Army Aviation Digest* is an official Department of the Army publication.

Dee A. Agee

**WHOOPS!** There "they" go again—making changes to how you, or more likely your unit, get the *Aviation Digest* and other publications.

At first glance the new procedures bring out that burning feeling in your stomach, and that dull, pounding ache in your head. For example, a person quickly encounters the fact that:

Department of the Army Circular 310-84-3, dated 15 August 1984, supersedes DA Form 12-11, dated 1 April 1972, and DA Form 12-25, dated 1 February 1971.

A second glance reveals such controlling references as:

AR 310-1; AR-310-2; DA Pamphlet 310-10; "R" forms such as DA Form 12-R; DA Form 12-5-R; DA Form 12-99R; and various other combinations of numbers, letters and instructions.

However, closer observation indicates that the changes are really not so bad, and they might even make it easier to get the *Aviation Digest.*

Let's deal with the *"R" forms* first, because they seem to be the most mysterious of the new numbers and letters.

The "-R" added to a form number simply means that the form is designed for local reproduction. Photocopies of these forms should be made because they cannot be obtained through "normal forms supply channels."

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to get the *Aviation Digest* are printed in DA Circular 310-84-3. You are supposed to make copies, fill the copies out and mail them to the preprinted address on each form.

The next question is obvious: Where do you get DA Circular 310-84-3? Your unit should have received it through those same ole normal forms supply channels by now. If not, ask for it at your next higher AG level. If all of that fails, write to the *Aviation Digest* at P.O. Drawer P, Ft. Rucker, AL 36362-5000, or call on AUTOVON 558-6680 or FTS 533-6680 and we'll send you copies of the R forms needed to get the *Aviation Digest*. But you should be able to get the forms, or DA Circular 310-84-3, from your unit.

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- their address has changed
- their status has changed (i.e., reorganization, redesignation, etc.)
- they desire new or additional accounts (one DA Form 12-R must be submitted for each account requested).

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In the future, should it become necessary for you to revise your needs for the *Aviation Digest,* just submit DA Form 12-5-R again and be sure to check "change" in block 3.

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# Aviation Laser Hazards

Captain Joseph S. Jablecki

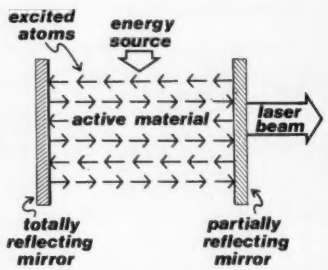
**Lasers (light amplification by stimulated emisson of radiation) are categorized according to power output and safety features. Although lasers are hazardous to skin and hair tissue, damage to the eye is more susceptible through either one or a combination of thermal, thermoacoustic or photochemical injury. Aviation personnel must first understand the principles of lasers to take full advantage of their safety features and to avoid laser hazards.**

MANY AVIATORS (most people for that matter) do not understand the operating principle of laser devices, or the methods in which laser energy produces injury in human tissue. Consequently, some aviators have an undue fear of the laser devices they must work with while others do not fear them enough. Lasers can produce crippling injuries, and a healthy respect for them is advisable and encouraged. Current U.S. Army field laser applications use low, mid and high power devices. Fortunately, these lasers have many safety features incorporated into them. If aviators are to take full advantage of these safety features, they must understand their purpose so that shortcuts will not be attempted.

Let's get a basic understanding of the laser's operating characteristics. The word *laser* is an acronym for light amplification by stimulated emission of radiation. It is like a light amplifier. As a sound amplifier uses electronic energy to increase the level of sound, the light amplifier uses light or electronic energy to increase the light level. To produce the laser light, a material (i.e., ruby rod, Helium-Nem gas) is bombarded with energy which excites the atoms. These stimulated atoms release energy in the form of light which has unique characteristics and is many times more intense than the incident light (figure 1). So, the laser does not simply amplify light but rather generates light.

How can light hurt us? Light is a physical agent just as sound is. The energy of both sound and light travels in waves. The higher the intensity of these waves, the more capable they are of penetrating matter (such as human tissue). The hazard of intense light has long been recognized. Socrates, in Plato's *Phaedo,* spoke of solar eclipse blindness and suggested that a preventive technique was to view the eclipse indirectly by observing the sun's reflected image in water. Intense light can only affect tissue or organs which are exposed to the light (skin, hair and eyes). The primary hazard from laser light is to the eyes as they are by far the most photosensitive. Switched lasers with peak powers in excess of 100 unequawatts have damaged internal organs in mice and rabbits. Damage to the eye from laser light can occur by one or a combination of three mechanisms.

FIGURE 1: Schematic of a laser.




- *Thermal Injury*—This is a process in which tissue protein is denatured through the absorption of energy and conversion into heat. This is similar to the method in which a microwave oven cooks food and it is the principal injury mechanism for producing retinal burns.
- *Thermoacoustic Injury*—This damage is the result of a process by which the laser beam generates sound in a gas through which it is passing. The light energy is transformed into pressure fluctuations within the tissue. The vibrations produced in the vitreous body of the eye can cause serious damage to include tearing of the retina.
- *Photochemical Injury*—This damage results from the breaking of chemical bonds through the reactions of excited molecules produced by the absorption of light. In other words, the light causes a reaction which changes the nature of the tissue into something different than its original form. An example of photochemical change would be polaroid film as the light triggers the chemical developing. The lens and cornea of the eye are most susceptible to this type of injury mechanism.

The human eye is composed of several different functioning parts. The most susceptible to damage by laser energy are the cornea, lens and

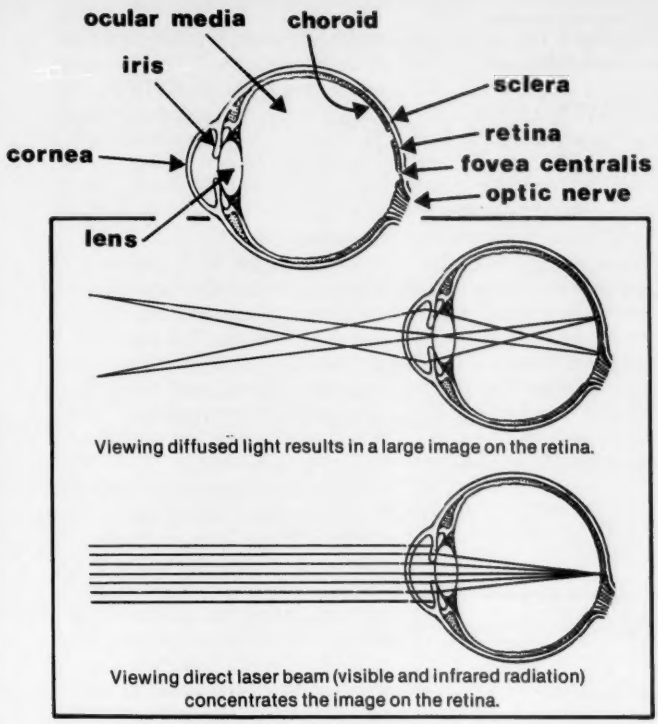



**FIGURE 2: Focusing properties of the eye.**

retina. High energy lasers can damage all structures of the eye; ruby lasers have their greatest effect on the retina and choroid; neodymium affects the ocular media most; and the $CO_2$ laser affects the cornea and anterior segment. The focusing capability of the lens can concentrate light rays by a factor as much as 100,000 times onto the retina (figure 2). Therefore, it is the retina that is by far the most susceptible to laser light damage.

Laser devices are placed into one of four hazard categories depending upon their power output and safety features.

- **Class I** lasers are exempt laser systems which are considered to be incapable of producing any damaging radiation levels. These are the lowest powered lasers and an example would be the M16 Multiple Integrated Laser Engagement Simulation (MILES) simulator (figure 3).
- **Class II** lasers are low-risk systems with a low-hazard potential due to the expected aversion (blink) response. These are only dangerous if the viewer overcomes his or her natural aversion to bright light and continues to stare into the source.
- **Class III** lasers are medium powered devices which have a moderate risk associated with their use. Intrabeam viewing or specular reflections of the beam will cause injury within the natural aversion response time (faster than the blink of an eye). These devices normally

| Device | Unaided Viewing | Telescopic Viewing |
|---|---|---|
| M16 Rifle (XM 60) | | |
| Blank Fire | 0 (m) | 0 (m) |
| Dry Fire | 7 | 0 |
| M60 machinegun (XM 61) | | |
| Blank Fire | 0 | 0 |
| Dry Fire | 7 | 0 |
| Controller gun (XM 251) | 0 | 0 |
| Tank Mounted Machinegun (XM 63) | 7 | 0 |
| 105mm Tank Gun from end of gun tube (XM 65) | 7 | 70 |
| 152mm Tank Gun and Shillelagh Missile from end of gun tube (XM 67) | 9 | 72 |
| TOW Missile (XM 64) | 12 | 75 |
| Dragon Missile (XM 62) | 7 | 75 |
| Viper Rocket (XM 68) | 0 | 0 |

Data courtesy of Mr. Wes Marshall, Laser/Microwave Division, U.S. Army Environmental Hygiene Agency

**FIGURE 3: Cautionary distances for eye exposure to MILES.**

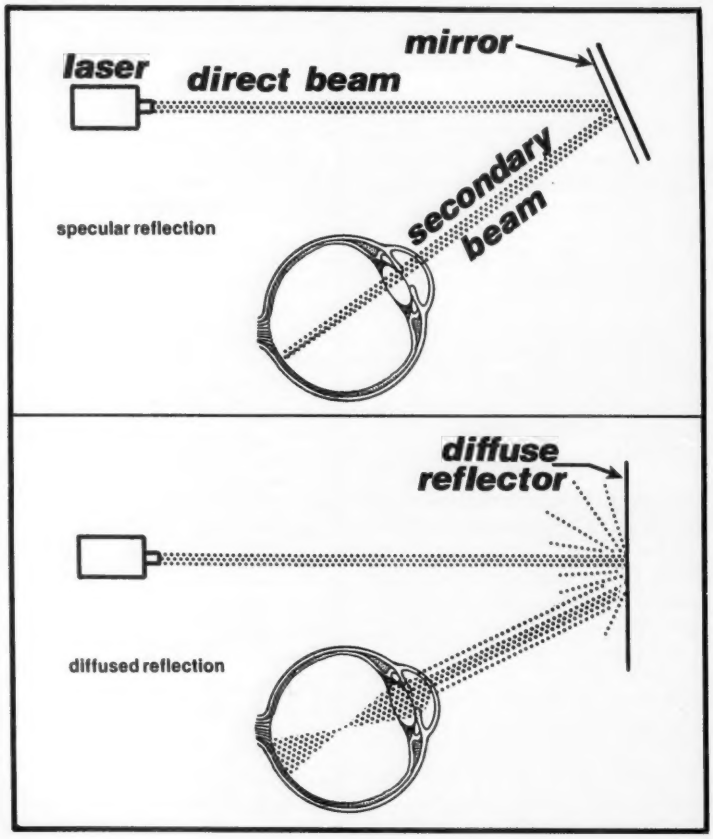
The MILES is an ingenious system for scoring tactical exercises. This is accomplished through an infrared beam omitted from each weapon and detected by a target which can be a person or vehicle. These devices do not present a hazard during normal field exercises. However, the beam is quite concentrated as it leaves the transmitter and cautionary measures are advised at extremely close engagement ranges. The table provides distances within which the weapons should not be pointed at the face of another person. Since optical aids tend to concentrate this energy, these distances may be extended when unfiltered optical aids are used. In most cases, greater hazards than from the infrared energy exist during training exercises. In the case of the the M16 rifle, a person would be more likely to receive an eye injury from the impact of the blank fired at close range than from the infrared energy.

are not capable of producing any serious skin injury. Examples would be the TOW (tube-launched, optically-tracked, wire-guided) XM-64 MILES system, the AH-1 LAAT (laser augmented airborne TOW) and most laser rangefinders.

• **Class IV** lasers are high-powered systems whose direct or diffusely reflected radiation is hazardous. These systems require the use of extensive controls to prevent exposure to the eye and skin. Examples of these devices would be the M60A3 AN/VVG-2 rangefinder and almost all laser designators.

When any class III or IV laser is operated in the training environment, very tight safety controls are required. The major control is that the operator obey the warning "DO NOT AIM OR FIRE LASER AT UNAUTHORIZED TARGETS." Any aircraft is an unauthorized target. The hazard of most concern to today's aviator is that of specular reflection of a class III or IV beam. Specular reflection is the direct transfer of laser energy off a flat reflecting surface such as a small pond of calm water, a vehicle windshield or a rearview mirror (figure 4). Even though these objects exist in our training environment in abundance, the likelihood of a beam being reflected up toward an aircraft and into the eyes of the pilot are remote.

**FIGURE 4: Comparison of specular and diffused reflection.**




When the eye is aided by an optical device, such as binoculars or the telescopic sight unit (TSU), the danger of injury is greatly increased. To protect the aviator using the TSU, a laser filter was built into the lens system. This filter will protect the aviator from the LAAT rangefinder's beam wavelength of 1,064 nm (figure 5). It will not provide protection against a beam from a different laser operating on a different wavelength. The AN/PVS-5 and ANVIS (Aviation Night Vision Imaging System) night vision goggles devices will "white out" at the first hint of intense light but still protect the aviator's eyes.

Is protection against our lasers our only concern? What about the enemy? There is good reason to believe the high-powered laser devices could be used as weapons to blind pilots and thus destroy the aircraft. If the weapon operated on a single wavelength (monochromatic) then a simple filter could be incorporated into both the visor of the SPH-4 and Integrated Helmet and Display Sighting System (IHADSS) helmets. It's more likely, however, that the weapon will be tunable to operate on several wavelengths. In this event, it would not be possible to place numerous filters into the visor and still be able to see out and fly. Research is being conducted to develop an omnifilter that would photochemically react to the laser light and selectively filter the damaging wavelengths while allowing enough visual acuity to fly the aircraft. Photochemical filters are very unlikely in an Aviation environment, holographic filters are the best bet for multiple wavelength protection. However, such a filter is currently far from reality.

The feasibility of piloting the aircraft by viewing through cathode ray tubes is also under study. This would mean two dimensional flying in a combat environment. The advantage? The televison receptor would be burned out by the laser beam rather than the pilot's retina.

| Device | Mode | Single Pulse | Multiple Pulse | Optically Aided Viewing | Built-in Eye Protection | Required Eye Unaided | Protection Total |
|---|---|---|---|---|---|---|---|
| AN/PVS-5 | R | 1.1 km | NA | 8.5 km | yes | 3.5 OD @ 1,064 nm | 4.4 OD @ 1,064 nm |
| | R-19 dB | 90 m | NA | 1.2 km | yes | | |
| | R-29 dB | 18 m | NA | 400 m | yes | | |
| AN/PAQ-1 | D | | 7.7 km | 33 km | yes, 4 OD | 4.2 OD @ 1,064 nm | 5.8 OD @ 1,064 nm |
| AN/PAQ-3 | R | 6.5 km | NA | 35 km | yes, 5.5 OD | | |
| | D | 5.8 km | 20 km | 79 km | yes, 5.5 OD | 3.9 OD @ 1,064 nm | 5.6 OD @ 1,064 nm |
| AN/TVQ-2 | R | 8 km | NA | 40 km | yes | | |
| | R-Filter | 2.4 km | NA | 22 km | yes | | |
| | D | 15 km | 25 km | 80 km | yes | 3.8 OD @ 1,064 nm | 5.5 OD @ 1,064 nm |
| LAAT | R | 3.4 km | 5 km | 30 km | yes | 3.4 OD @ 1,064 nm | 4.5 OD @ 1,064 nm |
| AN/VVG-2 | R | 10 km | NA | 50 km | clip-on | 4.5 | 4.5 |

SOURCE: Sliney, D.H., Ocular Protection for Laser Hazards, AEHA Briefing, 20 January 1982. Data courtesy of Mr. Wes Marshall, Laser/Microwave Division, U.S. Army Environmental Hygiene Agency.

**FIGURE 5: Nominal ocular hazard distances (NOHD) and eye protection requirements.**

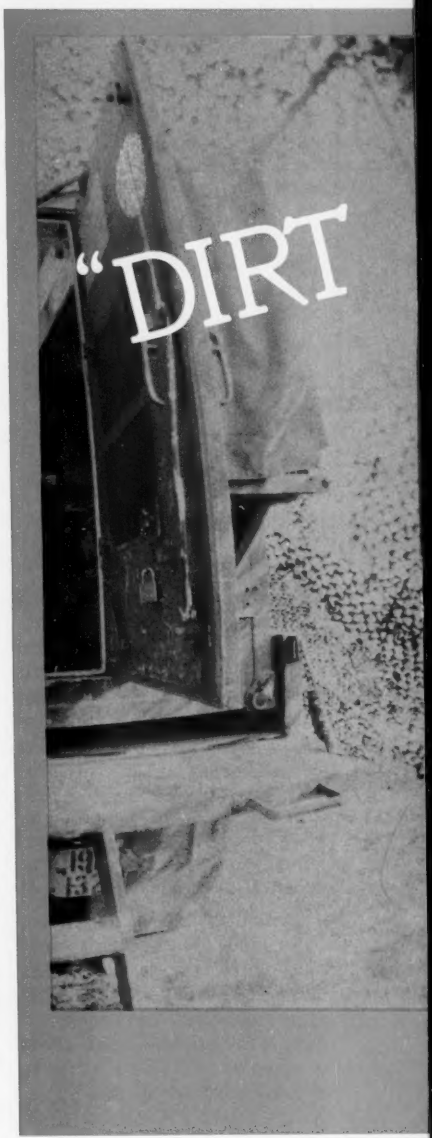
Let's hope the day for that type of protection never comes! Let's take full advantage of the protection and safeguards we have and use them in today's training environment. The use of lasers can be safe if you know the risks and know how to protect others as well as yourself. If you are an aviator using laser technology as part of your aircraft system, then be familiar with AR 40-46, AR 385-63 and TB Med 279. These references provide expert guidance for the control of health hazards associated with laser devices. All aviators should check range information bulletins at least once daily to avoid training areas where lasers are in use.

Take a minute and think about how much your eyes are worth to you. How much would you pay to get your sight back if you lost it? All the money in the world won't buy back your sight once the retina has been destroyed by laser light. The damage is permanent and sight is gone *forever!*


ABOUT THE AUTHOR

**Captain Joseph S. Jablecki received his direct commission into the Medical Service Corps as an environmental sciences officer in December 1974. He served as the preventive medicine officer to the First Infantry Division and then commander of the 48th Medical Det (LB) prior to his attendance in ORWAC class 78-44. Following completion of the Rotary Wing Aviation Course he was assigned as a section leader for the Third Flight Platoon, 507th Medical Co (AA). He recently completed his master's degree in public health at Tulane University specializing in environmental science. Captain Jablecki was the operations officer of the 377th Medical Co (AA), Seoul, Korea, prior to his assignment to Ft. Detrick, MD.**

# Managing Team Spirit Airspace




**This month the *Aviation Digest* completes its coverage of the Team Spirit 84 series. The concluding article, "Managing Team Spirit Airspace, Dirt to 600," by Major Maurice Brooks focuses on how the direct support of the 125th Air Traffic Control Battalion (Corps) assisted in allotting unusually crowded airspace below 600 feet to aviators, thus allowing them to operate safely in this joint team effort of the ROK/U.S. CFC exercise. The first articles, "Team Spirit 84: An Army Aviation Overview" and "View from the Eagle's Nest," appeared in the August issue. In September the *Aviation Digest* coverage continued with "Fit to Fight," "Dustoff Does It Better" and "45th Transportation Company Keeps 'Em Flying."**

**Major Maurice Brooks**

Major Brooks is assigned as the 125th Air Traffic Control Battalion liaison officer. A 17-year Army veteran, he has been in Korea since May 1983.

TEAM SPIRIT 84

Copies of any of the articles in this series can be obtained by writing to Editor, *Aviation Digest*, P.O. Drawer P, Ft. Rucker, AL 36362-5000 or by calling

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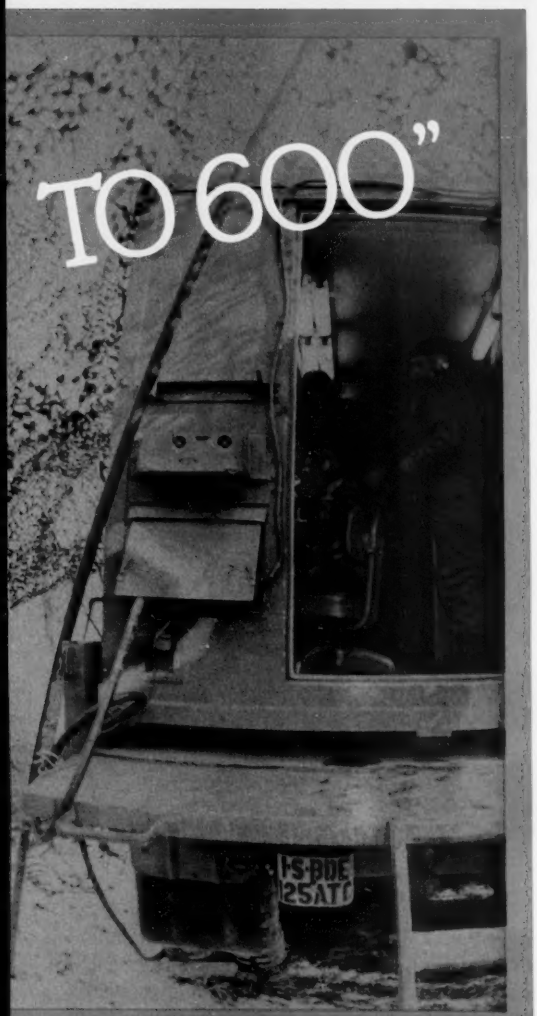



Camouflage netting hides an AN/TSQ-61B flight control van from aerial observation. The van is a self-contained unit designed for field operation.

STRAINING FOR a glimpse of the telltale silhouette in the early morning gloom, a rifleman at an observation post cranks his field phone to alert the command post of an impending attack. Before he even finishes reporting his position, his voice is drowned out in the roar of two flights of UH-1 Hueys, eight in each, that sweep past his flank to descend the backside of the mountain on a furious roller coaster dash to an unseen landing zone. The tactical surprise is complete. The AirLand Battle has begun. Orange Forces are moving on attack, and Team Spirit 84 is underway.

That was the curtain-raiser for this year's maneuvers in the Republic of Korea (ROK), the largest joint, combined field training exercise conducted by free world forces anywhere. There was, in Team Spirit 84, significantly greater emphasis on employment of AirLand Battle doctrine into the tactical maneuvers. This emphasis created some unusually crowded skies that, because of the limited size of the South Korean landmass and the threat from North Korea less than 25 miles from Seoul, already present a formidable challenge to Army aircrews and air traffic controllers alike. There is an inherent need for stringent airspace control measures within the airspace available.

A large share of the responsibility for helping aircrews negotiate the confined airspace belongs to the Army's 125th Air Traffic Control Battalion (Corps), headquartered in Seoul. Though the U.S. Army has performed air traffic control (ATC) functions in Korea since the 1960s, the 125th, in its current configuration, was not formed until 1978. Since then, the unit's internal organization has been continually refined to meet the challenge of providing adequate fixed base and tactical ATC resources to support the Aviation community in both garrison and field environments.

The 125th ATC Battalion is organic to the 1st Signal Brigade. The battalion's mission is basically to furnish flight following, altitude penetration coordination, terminal control for U.S. Army airfields and individual ATC services requested by the units that the battalion supports. For such tactical operations as Team Spirit, the 125th installs, operates and maintains tower, radar,

AUTOVON 558-3118.

flight following and navigational aid facilities to support the Aviation community missions.

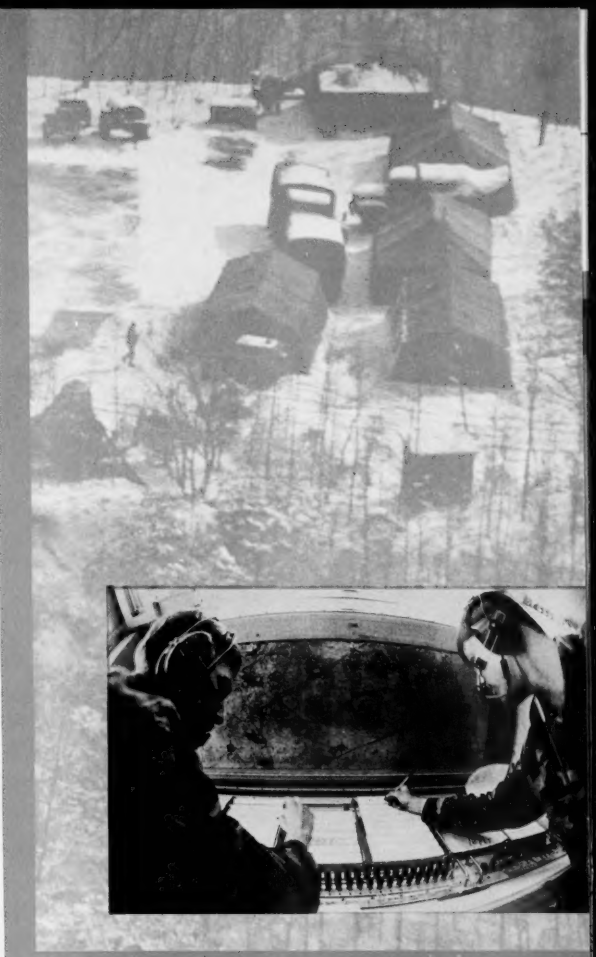
The 125th ATC Battalion has a multifaceted mission that necessitates striking a fine balance between human and equipment resources to ensure that correct types and amounts of ATC coverage are provided when and where they are needed.

Commanded by LTC William F. Dismukes, the battalion is configured with a Headquarters and Headquarters Detachment and two forward ATC line companies, the 191st and 244th. The 191st is responsible for providing ATC support in the northern areas of the ROK, including the demilitarized zone (DMZ). It operates seven fixed facilities: Flight Operations Center (FOC) North, Flight Coordination Centers (FCCs) Warrior and Evenreach, and four Army airfields that support the 128th Aviation Company, 4/7th Air Cavalry Squadron and the 2d Infantry Division's Aviation Battalion. The FOC and FCCs are responsible for flight following aircraft operating in and near the critically sensitive DMZ and buffer zone areas. They are collocated with mountaintop ROK air defense sites.

The 244th ATC Company is responsible for providing similar ATC support from Seoul southward. The 244th operates FOC South, located on Namsam Mountain in the heart of the capital city. It has a direct communications link with U.S. Air Force air control and radar facilities to enhance the effectiveness of the early warning air defense system. The 244th also operates a VIP (very important person) heliport which serves Headquarters, ROK/U.S. Combined Forces Command (CFC) and Eighth U.S. Army. Dignitaries from Bob Hope's road show to senior military officers and President Reagan have transited this Seoul-based facility.

Desiderio Army Airfield at Camp Humphreys, about 45 miles south of Seoul, provides the Army's only fully instrument flight rule equipped Army airfield in the ROK. The 244th's primary support at Desiderio is to the 19th Aviation Battalion, 45th Transportation Company (AVIM), and the 3d Military Intelligence Battalion, which is furnished 24-hour ATC recovery services for aircraft performing real-world reconnaissance missions. In the southernmost region, the company operates control tower facilities at Camp Walker Army Airfield in Taegu.

The 191st and 244th each have two tactical ATC platoons that deploy to support emergency procedures and



A Team Spirit helipad with (from left to right):

night vision goggles training, as well as unit flield training exercises (FTXs) and larger scale maneuvers such as Team Spirit 84. But a lot of complex planning, coordinating and rehearsal precede that deployment. The early morning airmobile assault carried out by the Orange Force to get Team Spirit's FTX phase rolling could not have been accomplished in reasonable safety without the aid of Army air traffic controllers managing airspace below 600 feet AGL (above ground level) or, as the users prefer, "dirt to 600."

Team Spirit planning is a dynamic process. Once the exercise ends and after-action reports are prepared and

- A flight control van showing the console and a map of the "sand box" defining the Aviation operations area,
- An AN/TPN-18 radar transmitter/receiver group which is part of the AN/TSQ-71B ground control approach system,
- An AN/TSQ-61B flight control van camouflaged with netting,
- The flight control van staffed by two flight data operators and a shift supervisor.

dissiminated, the cycle starts over: Initial meetings and conferences are conducted in late spring and during the summer to discuss the next Team Spirit exercise. Lessons learned are surfaced and proposed solutions are presented by coordinating agencies and units, followed by the preparation of draft exercise plans.

The battalion's liaison staff interfaces with ROK/U.S. CFC, the Eighth Army, the Air Component Commands of the Eighth Army and ROK forces, the Korean Ministry of Transportation, civil aviation authorities and other organizations to coordinate ATC support for each Team Spirit exercise. Some areas which must be addressed by the battalion are: negotiating for real estate on which to place tactical ATC facilities; designing technical data for instrument recovery procedures; conducting reconnaissance; requesting frequencies and landlines; preparing ATC instructions and agreements between civilian and military organizations; providing CFC with ATC input for the Team Spirit rotary wing procedures guide; coordinating airspace matters with the other services and the ROK forces; conducting briefings; and a multitude of other tasks integral to the establishment of a tactical ATC network capable of supporting Team Spirit.

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The greatest challenge comes in the negotiations for airspace. Such problems as allowing slow moving helicopters to enter the "upper" airspace normally restricted to high performance aircraft, and coordinating the flight of "fast movers" in the rotary wing regime must be resolved. Since the U.S. Air Force controls the altitude above 700 feet, and the Army controls dirt to 600 feet, the two services must coordinate closely.

Except for selected ATC elements deployed in a direct support of maneuver units (i.e., towers, GCAs (ground controlled approaches), etc.), the ATC facilities provide general support of all forces: Orange, Blue and Neutral. A good example is the tactical FOC/FCC system. It is stratgically deployed to provide optimum radio coverage of the entire maneuver area. The mission of the FOC/FCC system is to provide in-flight advisories, flight-following services and advice on special use airspace in the maneuver area. Aircrews can check in with the nearest FCC and be provided with the latest information regarding simulated B-52 strikes, airdrops, close air support missions and airmobile operations, etc., that could cause a dangerous situation or interfere with their own planned flight routes. The tactical FOC/FCC system is the most visible ATC Aviation safety service the 125th ATC Battalion provides during Team Spirit.

This year, the FOC/FCC system in Team Spirit was composed of four sites using AN/TSQ-61B shelters, mounted on 2½ ton trucks. The 191st ATC Company operated FOC Central in Wonju and FCC Indian on the "rocky top" site at Yongmunsan, collocated with the Team Spirit U.S. Air Force Control and Reporting Center. The 244th ATC Company operated FCC West at Bayonne site, near Yong-in. FCC East, in the vicinity of Hongchong, was operated by an augmenting ATC unit, the 5/57th Platoon from Hawaii.

To facilitate aircrew understanding of rotary wing procedures for flight at lower levels (600 feet AGL and below) during Team Spirit, the battalion provided a detailed explanation of flight following in a CFC Team Spirit rotary wing procedures guide. The guide contained a list of commonly used radio frequencies, certain navigation procedures, fuel points, medevac availability and helicopter emergency instrument recovery procedures. In the past, aviators showed some reluctance to use of the tactical FOC/FCC system, considering it too restrictive. Now they use it routinely because of the obvious safety advantages the system provides. Advisories concerning conflicting traffic and hazardous conditions are issued, and the FOC system has a communications tie-in to medevac facilities which can be quickly contacted to provide search and rescue assistance to downed aircrews.

During Team Spirit 84, the battalion handled more than 12,400 movements—a major increase over the Team Spirit 83's total of 7,000—which comes out to more than 1,000 movements daily. So it is clear that aviators today rely heavily upon the tactical FOC/FCC system.

Tactical tower and nondirectional beacon (NDB) services were provided to both the 2d and 25th Infantry Divisions as well as the Combined Aviation Force's Task Forces 19 and 52. The ATC elements assigned to support them remained in close coordination throughout the exercise and were displaced along with the supported units. Additionally, tower and instrument approach support was rendered to Ground Component Command tactical locations and at the temporary tactical air assault strip constructed by Army Engineers on the South Han River bank. The assault strip handled U.S. Air Force C-130 and ROK Air Force C-123 aircraft conducting ROK/U.S. Army and Marine Corps troop lifts, medical evacuation and resupply missions.

The battalion's boldest initiative for Team Spirit 84 was the establishment of a new vertical helicopter instrument recovery procedure, or VHIRP. Designed solely for use during the exercise, the VHIRP provided a network of tactical navigation NDBs and GCA radars to assist aircrews in recovery at airfields within the maneuver area in the event they encountered instrument meteorological conditions (IMC). The special recovery procedure was implemented to fill the void of available instrument facilities within the designated FTX area. Without the VHIRP, aircrews might not find a suitable place to land if the weather deteriorated and they were caught off guard. The Team Spirit VHIRP was designed to be basic and simple, so that crews could adjust with little effort. It called for initiating a climb to 7,500 feet, mean sea level, transmitting (squawking) 7700 on the transponder, establishing a track toward one of two tactical NDBs and contacting the U. S. Air Force ground control intercept (GCI) station, nicknamed Poncho, and requesting assistance. From that point, the GCI would provide heading and distance information to the aircrew, with GCI radar, until the aircraft reached an in-

Keeping track of scores of helicopters operating within the training area is the job of field deployed air traffic control personnel.

itial approach fix tactical NDB. While en route, Poncho advised the aircrew which Army or ROK Air Force ATC facility to contact in order to execute Army tactical NDB or GCA approaches and perform a safe recovery. There were also provisions for VHIRP recovery of aircraft experiencing two-way radio failure while under inadvertent IMC.

The battalion also developed two aerial corridor extensions for the exercise area to enable Task Forces 52 and 19 aircraft to fly from airfields outside the maneuver area directly into Team Spirit airspace without the burden of filing an administrative flight plan.

Several small-scale exercises, including a battalion ARTEP (Army Training and Evaluation Program), were conducted prior to Team Spirit for additional training and to enhance experience in furnishing tactical ATC services. While the soldiers perform controller tasks at fixed base sites and during individual unit field exercises, it is only when they deploy on a tactical exercise that is the *magnitude* of Team Spirit that they receive the opportunity to practice the battalion's *comprehensive* capabilities in a fully integrated fashion.

In addition to deploying the battalion's soldiers and equipment in direct, operational ATC roles, there is also a requirement to ensure the information affecting airspace management is obtained in a timely manner. The best way is to employ members of the battalion as liaison personnel. Thus, representatives from the line companies perform liaison functions in conjunction with their normally assigned duties. They work closely with division airspace management elements and supported units. They are also placed in towers and GCA facilities operated by ROK forces to help aircrews and ROK controllers overcome language difficulties. Similarly, ROK forces augment some of the battalion's facilities.

The battalion's full-time ATC liaison element is placed directly in the airspace management elements of the Tactical Air Control Center at Osan Air Base. It is tasked to furnish all pertinent information to the battalion's tactical operations center and into the FOC/FCC system so critical information can be provided to aircrews operating within the maneuver area's airspace. This enhances Aviation safety and airspace management.

One of the main links that tie the battalion's operations together is the organic Aviation section which operates and maintains three UH-1 helicopters. The battalion's various elements are scattered from the DMZ to the far south and many places in between, including rocky top radar defense sites. Without the use of organic rotary wing aircraft to transport personnel and materiel around the country, and the dedicated crews and maintenance personnel who fly and fix them, the battalion would be hard pressed to perform its mission as efficiently as Team Spirit 84 demonstrated it could.

**"Hangar Talk" is a quiz containing questions based on publications applicable to Army Aviation. The answers are at the bottom of the page. If you did not do well, perhaps you should get out the publication and look it over.**

## Aviation Life Support Equipment (ALSE)

*AR 95-17 and FM 1-302*

**Major John J. Fearing**
Aviation Safety Officer
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Willow Grove NAS, PA

**1.** Which of the following is responsible for providing proper ALSE training commensurate with the unit's operational mission?
a. Flight surgeon or aeromedical advisor
b. Aviation safety officer
c. Unit commander
d. Aviation life support officer

**2.** The authority to carry controlled drugs in first aid kits is listed in:
a. AR 40-8
b. AR 95-1
c. AR 95-17
d. AR 40-61

**3.** When an Army aviator is equipped with a parachute, the appropriate personal flotation device is the:
a. LPU-2/P
b. LPU-10/P
c. LRU-4/P
d. LRU-1/P
e. none of the above

**4.** Approved oxygen systems will be used on all Army aircraft when flight above 12,000 feet pressure altitude is for:
a. Less than 1 hour
b. Any period of time
c. 30 minutes
d. More than 1 hour
e. Flight above 12,000 feet is not allowed in Army aircraft

**5.** What altitude can the foliage penetrating signal kit flares reach and how many miles are they visible at night?
a. 2,000 feet—5 miles
b. 1,200 feet—4 miles
c. 1,100 feet—10 miles
d. 800 feet—3 miles

**6.** All occupants of Army aircraft flown over water will wear life preservers if the flight is:
a. Greater than 30 minutes
b. Below 3,000 feet
c. Above 3,000 feet
d. Greater than 100 nm from the nearest shoreline
e. All of the above

**7.** When the threat is sufficient for MOPP-1 for ground personnel the full complement of MOPP-4 equipment will be worn by all aircrews within how many miles of the forward line of own troops?
a. 50
b. 10
c. 5
d. 1

**8.** Which of the following subsystems are included in the Aviation Life Support System?
a. Life support survival and recovery
b. Escape and descent
c. Environmental life support
d. B and C above
e. All of the above

**9.** The Personnel Locator System has a frequency range of 225 to 300 MHz. How many miles can it interrogate the survival radio on a preplanned frequency over land?
a. 75 NM
b. 75 SM
c. 25 NM
d. 25 SM

**10.** AR 95-17, which was effective on 15 May 1984, does not apply to National Guard or U.S. Army Reserve Aviation units until 1 year from the effective date.
a. True
b. False

**ANSWERS**

**1.** c, AR 95-17, page 1-1, 1-4 (f)
**2.** d, FM 1-302, page 8-7, 8-4 warning!
**3.** e, FM 1-302, page 7-1, 7-1 (b)
**4.** c, AR 95-17, page 2-1, 2-4 (a)
**5.** c, FM 1-302, page 4-3
**6.** e, AR 95-17, page 2-2, 2-9 (d)
**7.** a, FM 1-302, page 6-3, 6-3 (b)
**8.** e, AR 95-17, page 1-2, 1-5 (b)
**9.** a, FM 1-302, page 11-7, 11-3 (c)
**10.** b, AR 95-17, page 1 applicability